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The Alaska Region

U.S. Department of Agriculture
Forest Service

Ecological Definitions for Old-growth Forest Types in Southeast Alaska

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FINAL REPORT

ECOLOGICAL DEFINITIONS FOR OLD-GROWTH FOREST TYPES
IN THE
ALASKA REGION

Prepared by the Ecology Steering Committee
USDA Forest Service
Alaska Region
February 1992

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INTRODUCTION

In 1990 a Region 10 Old-Growth Definition Core Group was established as a sub-committee of the Ecology Steering Committee, and charged with the task of developing ecologically based old-growth definitions for the Alaska Region. These definitions were to be consistent with the National old-growth position statement (attached) and the National old-growth definition development action plan. A definition development strategy that included other agency and interest group participation was developed and served as a guide to complete the task. The final working group to accomplish this task was titled the Region 10 Old-Growth Definition Task Group and included membership of: Forest Service (5); ADF & G (2); National Marine Fisheries Service (1); Alaska State Department of Natural Resources (1); Sealaska Corporation (1); Alaska Forest Association (1); Fish and Wildlife Service (1). SEACC (Southeast Alaska Conservation Council) and Audubon were invited as working group members but declined to participate. This Task Group identified the following specific products to be developed:

1. A matrix to illustrate minimum stand characteristics for each old-growth forest type.
2. Narrative descriptions of each old-growth type.
3. A technical report documenting definition development processes.
4. Recommendations for old-growth attributes to record during future inventories.
5. A final report to the Regional Forester that included the above four(4) items.
6. A field guide to old-growth forest types including items 1 and 2.
7. Appropriate USFS manual direction to implement the old-growth definitions and inventory recommendations.

This report constitutes item #5 and serves as the basic reference document for the old-growth definitions. Items #6 and #7 are under current development.

Old-Growth definition technical reports for both Southeast and Southcentral geographic areas were completed. These reports document quantitative minimum old-growth attributes, specific analysis procedures, old-growth forest type narrative descriptions, and definition implementation guidelines.

PROCESS DESCRIPTION

From January 1990 to February 1992 the old-growth definition products were systematically developed. The Task Group first focused on definitions for Southeast Alaska forest types. This was accomplished to allow possible inclusion in the Tongass Land Management Plan revision. During definition development it was determined that existing in-place data was not sufficient to apply these ecological definitions during this forest planning effort. The ecological definitions are referenced in the plan revision for inclusion in future forest inventories.

The Task Group intended that the definitions be based upon existing data to the greatest extent possible. This required substantial data conversion, manipulation and analysis. Specific processes and procedures to accomplish this were established to accomplish this and are described in the enclosed technical reports. The basic processes and procedures established to develop old-growth definitions for Southeast Alaska forest types were also used to develop definitions for Southcentral Alaska forest types.

OLD-GROWTH INVENTORY VALUES

The task group established appropriate old-growth forest types that are hierachically nested to Society of American Forester Forest Cover Types (for geographic compatability) and to Region 10 Plant Associations (for on-the-ground definition application). Ten (10) distinct old-growth forest types were identified for Southeast Alaska and nine (9) were identified for Southcentral Alaska.

Stand level attributes considered necessary to define a functioning old-growth stand were established. These are:

Main Canopy Attributes

# Large Trees/ac....a minimum number of trees of a specified minimum diameter and minimum age.

# Large Decadent Trees/ac....a minimum number of trees meeting the above criteria and possessing evidence of top, bole or root decadence.

Canopy and Stand Structure

# of Tree Canopy Layers....a minimum number of canopy layers to express vertical structure.

# of Diameter Classes....a minimum number of tree diameters present to express within stand variation.

Snags

# Standing Snags/ac....a minimum number of snags of a specified minimum diameter and minimum height.

# Decay Class Groups....a minimum number of snags meeting the above criteria and present in different states of decay.

Down Material

# Down Pieces/ac....a minimum number of down woody material of a specified minimum diameter and minimum length.

# Decay Class Groups....a minimum number of down material meeting the above criteria and present in different states of decay.

Forbs

Canopy Cover....a minimum percentage of forb cover present to express discontinuous canopy closure.

Through data analysis and professional judgement, the Task Group established minimum values for each of the stand attributes. Presence of all the above attributes at the minimum value or higher establishes the bottom threshold for a stand to be inventoried as functional old-growth. The minimum values for each of these attributes, by old-growth forest type, are listed in the Inventory Matrix found on page 3 of the enclosed technical reports. Specific attribute application information is found in the process description for each attribute in the technical reports.

DEFINITION USE

Direct application of these definitions will occur at the stand level. A stand is "A community of trees, possessing sufficient uniformity as regards composition, constitution, age, spatial arrangement, or condition, to be distinguishable from adjacent communities" (Society of American Forester Terminology). Old-growth forest type for a stand is determined by the major plant association of the stand. Groupings of Region 10 plant associations by old-growth forest type are listed in the appendix of each technical report.

Past inventories of old-growth in the Alaska Region have been based upon non ecological attributes such as stand age and volume. The major immediate use of these definitions is to provide a framework for inventory of the old-growth resource based upon ecologically functional differences (ie. old-growth forest types). Regional processes for accomplishing integrated stand level inventory are being currently developed. The old-growth attributes are being incorporated as part of those inventory processes, and additional inventory suggestions identified by the Task Group are being considered.

No attempt was made at this time to develop within or between old-growth forest type quality scales or management implications. However, development of these through modeling processes using the ecological framework the definitions provide would be an appropriate next step. To provide an immediate repository of this stand level information, the stand old-growth attributes have been incorporated into the Regions stand level Silviculture Information System.

MANUAL DIRECTION

Specific direction for implementation of the old-growth definitions during future inventories is being developed for incorporatation into the Regional directives system under 1909.14 - Resources Inventory Handbook.

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DEFINITIONS FOR OLD-GROWTH FOREST TYPES
IN
SOUTHEAST ALASKA

Old-Growth Definition Task Group

Technical Report

USDA Forest Service
Alaska Region

August 1991

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I. INTRODUCTION

The public has become greatly interested in the status and management of old-growth forests because of their many significant values. Although the term "old-growth forest" has been used frequently in the scientific literature and popular press, the lack of consistent definitions or descriptions has hampered the understanding of the issues by managers and the public. Recent research has demonstrated that all old-growth forests do not have the same ecological functions or values because they may have different structural characteristics. Thus, old-growth definitions must be specific to the particular forest types in an area.

To address the need for improved management of old-growth forests on the National Forest System, the Chief of the USDA Forest Service established a National Old-Growth Task Group in l988 with the charter of providing national consistency to old-growth forest management. In October l989, the Chief issued a national position statement on old-growth forests values. The position statement recognized the values of old-growth forests and called for the development of consistent definitions for all forest types. The definitions were to be based on stand structural attributes that have ecological functions. The position statement included a generic definition and description of old-growth forests to be used in the development of specific regional definitions.

In December l989, the Regional Forester, USDA Forest Service, Alaska Region, established an Old-Growth Task Group as a sub-committee of the Regional Ecology Steering Committee to develop ecological definitions for old-growth forest types in the Alaska Region. Personnel from other State and Federal resource management agencies along with the timber industry and conservation groups were invited to participate as task group members. SEACC (Southeast Alaska Conservation Council) and Audubon were invited as working group members but declined to participate. The charter of the Regional Old-Growth Task Group was to:

> -- Develop ecological old-growth definitions for forest types in the Alaska Region within the framework and direction of the National Old-Growth Action Plan --

The Team Leader of the Regional Task Group participated in the National Old-Growth Task Group and maintained coordination between groups.

The Regional Old-Growth Task Group met several times during l990 to establish a framework and process for developing the old-growth definitions. The Task Group decided to use available data bases and the experience of group members to develop the definitions. Members of the Task Group worked on various aspects of the project and reported back periodically to the complete group for their input and consideration. In order to document the process used to develop the old-growth forest definitions and to display the definitions to resource managers and the public, the Task Group decided that the following products would be produced:

l. A matrix to illustrate the minimum stand characteristics for each old-growth forest type;

2. Narrative descriptions of each old-growth type;

3. A technical report documenting definition development processes;

4. Recommendations for old-growth attributes to record during future forest inventories;
5. A final report to the Regional Forester that would include the previous four(4) items;
6. A field guide to old-growth forest types including items 1 and 2;
7. Appropriate USFS manual direction to implement the old-growth definitions and inventory recommendations.

It was decided that analysis of old-growth forest types should be done separately for Southeast and Southcentral Alaska because of the large geographic and ecological differences between these areas.

This report documents development of the old-growth definitions for Southeast Alaska that are applicable to the Tongass National Forest and contains a matrix (Table 1) that summarizes the minimum stand attributes required to define and inventory old-growth conditions for the forest types of that area.

II. FOREST TYPES

The National Old-Growth Task Group directed that Regional old-growth definitions be specific to forest type, habitat type, plant association, or groups of them. Further, the definitions should be framed within the Society of American Foresters (SAF) 1980 Major Forest Cover Types to provide geographic compatibility. The Task Group felt the SAF forest cover types were too broad to adequately describe old-growth types and the Region's plant association classification system is more detailed than needed. Therefore, a hierarchical system that nested Regional old-growth forest types between the SAF forest cover types and the Regional plant associations was developed (see Appendix A). This system is also shown on the Inventory Matrix (TABLE 1). While common reference will be made to "old-growth forest types", these types are titled sub-series on the Inventory Matrix to clearly illustrate the hierarchical relationship.

Ten (10) distinct old-growth forest types were recognized for Southeast Alaska. The types correspond closely to the SAF forest cover types and plant association series for major forest species which were further refined primarily on soil drainage. The ten old-growth forest types are:

Sitka spruce-alluvial	abbr., SS-AL
Sitka spruce-other	abbr., SS-O
Western hemlock-well drained soil	abbr., WH-WD
Western hemlock-poorly drained soil	abbr., WH-PD
Western hemlock/western redcedar-well drained soil	abbr., WH/WRC-WD
Western hemlock/western redcedar-Poorly drained soil	abbr., WH/WRC-PD
Western hemlock/Alaska-cedar	abbr., WH/AC
Mixed conifer	abbr., MIX CONIFER
Mountain hemlock	abbr., MTN HEM
Shorepine	abbr., SHOREPINE

Each of these old-growth forest types are comprised of groupings of particular plant associations (see Appendix A). Plant association identification will be the application method for identifying old-growth forest types on the ground.

The Inventory Matrix displays the minimum measurable stand attributes necessary to consider a stand as functional old-growth forest. Narrative descriptions of each old-growth forest type (Appendix B) describing major ecological interactions have been developed. More detailed discussions of ecological relationships and plant associations can be found in DeMeo (1989), Martin (1985,1989), and Pawuk and Kissinger (1989).

MATRIX OF OLD-GROWTH FOREST TYPE ATTRIBUTES FOR INVENTORY – TONGASS N.F.

TABLE 1

OLD-GROWTH FOREST TYPES

AUG 91

SAF FOREST COVER TYPE	#223		#224		#227		#227 VARIANTS		#205	#218 VAR
*PLANT ASSOC. SERIES	SITKA SPRUCE		WESTERN HEMLOCK		W. HEM/W.R. CEDAR		W. HEM/	MIXED	MTN	SHORE
*PLANT ASSOC. SUB-SERIES	ALLUV	OTHER	WELL DR	POOR DR	WELL DR	POOR DR	AYC	CONIFER	HEMLOCK	PINE
MINIMUM STAND ATTRIBUTES										
MAIN CANOPY										
# LARGE TREES/AC	6	7	21	17	16	15	28	12	12	18
# LARGE DECADENT TREES/AC	4	2	7	6	6	7	7	7	5	8
MIN DBH OF LARGE TREES	27"	23"	19"	15"	21"	19"	15"	11"	13"	9"
MIN AGE OF LARGE TREES	260	160	150	180	170	150	150	170	160	170
CANOPY & STAND STRUCTURE										
# OF TREE CANOPY LAYERS	2	2	3	2	3	3	3	3	3	2
# OF DIAMETER CLASSES	2	3	4	4	6	6	4	3	3	2
SNAGS										
# STANDING SNAGS/AC	2	1	2	3	5	3	3	4	2	2
MIN SNAG DBH	27"	23"	19"	15"	21"	19"	15"	11"	13"	9"
MIN SNAG HT	10'	10'	10'	10'	10'	10'	10'	10'	10'	10'
# DECAY CLASS GROUPS	2	2	2	2	2	2	2	2	2	2
DOWN MATERIAL										
# DOWN PIECES/AC	2	4	6	6	6	6	8	4	4	2
MIN DIA LARGEST POINT	27"	23"	19"	15"	21"	19"	15"	11"	13"	9"
MIN LENGTH	10'	10'	10'	10'	10'	10'	10'	10'	10'	10'
# DECAY CLASS GROUPS	2	2	2	2	2	2	2	2	2	1
FORBS										
CANOPY COVER	5%	5%	5%	5%	**5%	3%	10%	N/A	5%	N/A

EXPLANATION

WELL DR = WELL DRAINED SOILS POOR DR = POORLY DRAINED SOILS ALLUV = ALLUVIAL SOILS
OTHER = COASTAL SALT PLAINS, STIKINE LOESS, & OVER STEEPENED UPLANDS
MAIN CANOPY, CANOPY & STAND STRUCTURE, AND SNAG VALUES DERIVED FROM 1980s TIMBER INVENTORY DATA
CANOPY LAYERS AND DIAMETER CLASSES MUST HAVE AT LEAST 5 TREES/ACRE DIAMETER CLASSES ARE 2"
DECAY CLASS GROUPS FOR SNAGS ARE CLASS (1,2,3) YOUNG SNAGS AND CLASS (4,5) OLD SNAGS
DOWN MATERIAL AND AGE VALUES DERIVED FROM REGIONAL OLD-GROWTH TASK GROUP - PROFESSIONAL JUDGEMENT
DECAY CLASS GROUPS FOR DOWN MATERIAL ARE CLASS (1,2,3) YOUNG MATERIAL AND CLASS (4,5,6) OLD MATERIAL
FORB VALUES DERIVED FROM PLANT ASSOCIATION DATA SET **EXCEPT WH/WRC-SWORD FERN PLANT ASSOCIATION
*COMBINED SERIES AND SUB-SERIES ARE THE REGIONAL OLD-GROWTH FOREST TYPES

III. TASK GROUP REVIEW AND DECISION PROCESSES

The Regional Old-Growth Task Group was organized as a working group and met four times between May and November. From the onset, the Task Group strived to encourage active participation by all members and to achieve consensus on all aspects of definition development. The conclusions and products of the Task Group were supported by all members.

The first meeting on May 18 allowed Task Group members to become familiar with the issue and each other. The goals and procedures of the Task Group were established. Previous efforts to define old-growth in the Alaska Region (Conservation of Rain Forests in Southeast Alaska: Report of a Working Group, 1989) and National Forest Service direction on developing old-growth definitions were reviewed.

The group decided to produce an Inventory Matrix (Table 1) that summarized the minimum old-growth attributes needed for each forest type. This matrix would present the criteria to be used to define and inventory old-growth condition by forest type. The Task Group also decided to produce narratives to further describe each old-growth forest type. The narratives would assist displaying the old-growth forest type attributes and highlight some of the more subjective ecological relationships to managers and field personnel. A timeline for completion of the project was also established.

A technical sub-group (J. Boughton, J. Martin, and R. Flynn) was established on 25 May 1990 to work on specific aspects of the project. In particular, the technical sub-group reviewed available data bases and designed the analytical procedures used to determine minimum old-growth attributes for stands in the available data bases. The technical sub-group reported their findings back to the full group periodically for discussion and review. Also, the technical sub-group was responsible for producing this report.

Subsequent Task Group meetings further developed and finalized the format and content of products including the summary Inventory Matrix. At each meeting, the progress made by group members was reviewed and definitions were refined based on the work of the technical sub-group and professional judgment of the Task Group members. The definitions for Southeast Alaska were finalized after a November 2 meeting, except for a few modifications needed by changes in National direction resulting from a December 1990 meeting of the National Old-Growth Task Group. A field trip was made on November 5 by several members of the Task Group to view old-growth types in the Juneau area. This field verification indicated that with a few minor adjustments, the old-growth definition minimum criteria was appropriate for the types visited.

Through these processes National Forest Service direction was accomplished by developing definitions that are based on ecological function, applicable to specific forest types, and contain measurable structural characteristics that can be inventoried. Also, the appropriate attributes contained in the generic National definition were incorporated.

IV. DATA BASES

The Task Group decided the old-growth definitions (structural attribute values) should be based on actual field data to the greatest extent possible. Because structural attributes of all old-growth forest types in Southeast Alaska had not been specifically inventoried, the technical sub-group reviewed existing data sets for information that would allow comparison analysis for all the types. Although Alaback (1984) and Alaback and Juday (1989) discussed structural attributes of certain old-growth stands, their work was limited to two old-growth forest types and therefore, was not directly used for analysis.

Three(3) data sets were available that had sampled some stand attributes for all forest types. Sample design and collection procedures of these data sets were evaluated by the technical sub-group to determine their usefulness for estimating the minimum structural attribute values.

The data sets determined to be used for analysis of each old-growth stand attribute are as follows:

1. Main Canopy - 1980's Timber Inventory, some verification with the Plant Association Data.

2. Canopy and Stand Structure - Same as number 1.

3. Snags - Same as number 1.

4. Down Material - Task Group professional judgement.*

5. Forbs - Plant Association Data.

* Some information (e.g. down wood) was not useable from any available data set.

Although these data sets were collected for other purposes, the technical sub-group felt that the data could provide a useable analysis base for the majority of this project. However, followup monitoring and definition validation should be considered to eliminate an possible bias introduced through assumptions/procedures applied in order to use this available data.

A specific description of the data sets considered and assumptions/procedures used to establish the analysis base are as follows:

Timber Inventory Data Set: This data set was collected by Timber Management staff, USDA Forest Service, Alaska Region, during 1981-82 on the Chatham Area (Rogers and van Hees 1982), 1983-84 in the Stikine Area (Rogers and van Hees 1984), and 1984-85 on the Ketchikan Area (Rogers and van Hees 1985). The major purpose of these timber inventories was to estimate the timber resource on the Tongass National Forest for revision of the Tongass Land Management Plan. On the Stikine and Ketchikan Areas, the inventory consisted of ground cluster plots systematically located on a grid. At each cluster plot, five(5) variable radius sample points were established. One at the center and four(4) in each cardinal direction at a distance of about 270 feet. On the Chatham Area, the field sampling unit was a transect of variable radius plots stratified by timber type polygons. Fifty-five sampling units of about 250 acres each were located in the strata via PPS sampling methodology (probability proportional to size)(Rogers and van Hees 1982). Several attributes for each tree in the variable radius plots were recorded including species, stem diameter, height, age, and condition.

For analysis, a single data table (ORACLE software) was established by pulling appropriate stand structural attributes to analyze from each of the three area inventories. In the data table, each cluster plot(Stikine and Ketchikan) or stand transects(Chatham) represents attribute values of a single old-growth stand (see Appendix C for data table and coding descriptions).

Cluster plot information was individually reviewed to assign the plots to appropriate old-growth forest types. Stands that did not appear to be old-growth or plots that included more than one old-growth forest type were removed from the data set. These were primarily stands less than 150 years of age, composed of several old-growth forest types, or having probable recent disturbance(ie. poorly stocked-<16.7% stocking of sawtimber). The final data set contained 583 stands (TABLE 2) with information on over 30,000 individual trees. The data set resides on the Forest Service, Alaska Region, computer system in Juneau, Alaska.

TABLE 2 -Timber Inventory Plot Representation by Old-Growth Type

	OLD-GROWTH FOREST TYPES										
	SS-AL	SS-O	WH-WD	WH-PD	WH/WRC WD	WH/WRC PD	WH/AC	MIXED CON	MTN HEM	SHORE PINE	TOTAL
NO. OF PLOTS	20	35	74	59	37	28	89	112	119	10	583
% OF SAMPLE	4%	6%	13%	10%	6%	5%	15%	19%	20%	2%	100%

Plant Association Data Set: This data set was collected by Regional Ecology Program staff, USDA Forest Service, Alaska Region, from 1981 to present. The purpose of this data set was to develop a plant association classification system for Southeast Alaska (Martin 1989). The data set consists of summary vegetation information for selected stands. Within each stand, the percent canopy cover of all vascular plants was estimated. Also, a variable radius plot was located in the center of each stand. Stem diameter of each count tree was measured and total height was estimated. Independent data sets from the Chatham, Ketchikan, and Stikine areas were combined and contain information on approximately 2000 stands. The stands were categorized into the appropriate old-growth forest types using the cross reference in Appendix A. Due to sample design and collection procedures, it was decided the Timber Inventory data set would be a better data set to use for tree attributes. This data set was also considered for the down material attribute, however, collection procedures did not allow analyzing for particular piece size. The data set resides on the Forest Service, Chatham Area, computer system in Sitka, Alaska.

Multi-resource Forest Inventory Data Set: This data set was collected by Forest Inventory and Analysis staff, USDA Forest Service, Forest Sciences Lab, Anchorage, during 1984. The primary purpose of this data set was to provide Southeast Alaska multi-resource information for the 1990 Resources Planning Act report. Twenty acre sample plots (approximately 55) were systematically located on a 40 kilometer grid. Forest types were identified on each sample plot and sub-samples within these types were taken. Due to sample size it was decided the Timber Inventory data set would be a better data set to use for tree attributes and the Plant Association data set would be a better data set for the forb attribute. This data set was considered for the down material attribute, however, sample categorization did not allow analyzing for particular piece size. The data set resides on the Forest Service, Forest Inventory and Analysis group computer system, Anchorage, Alaska.

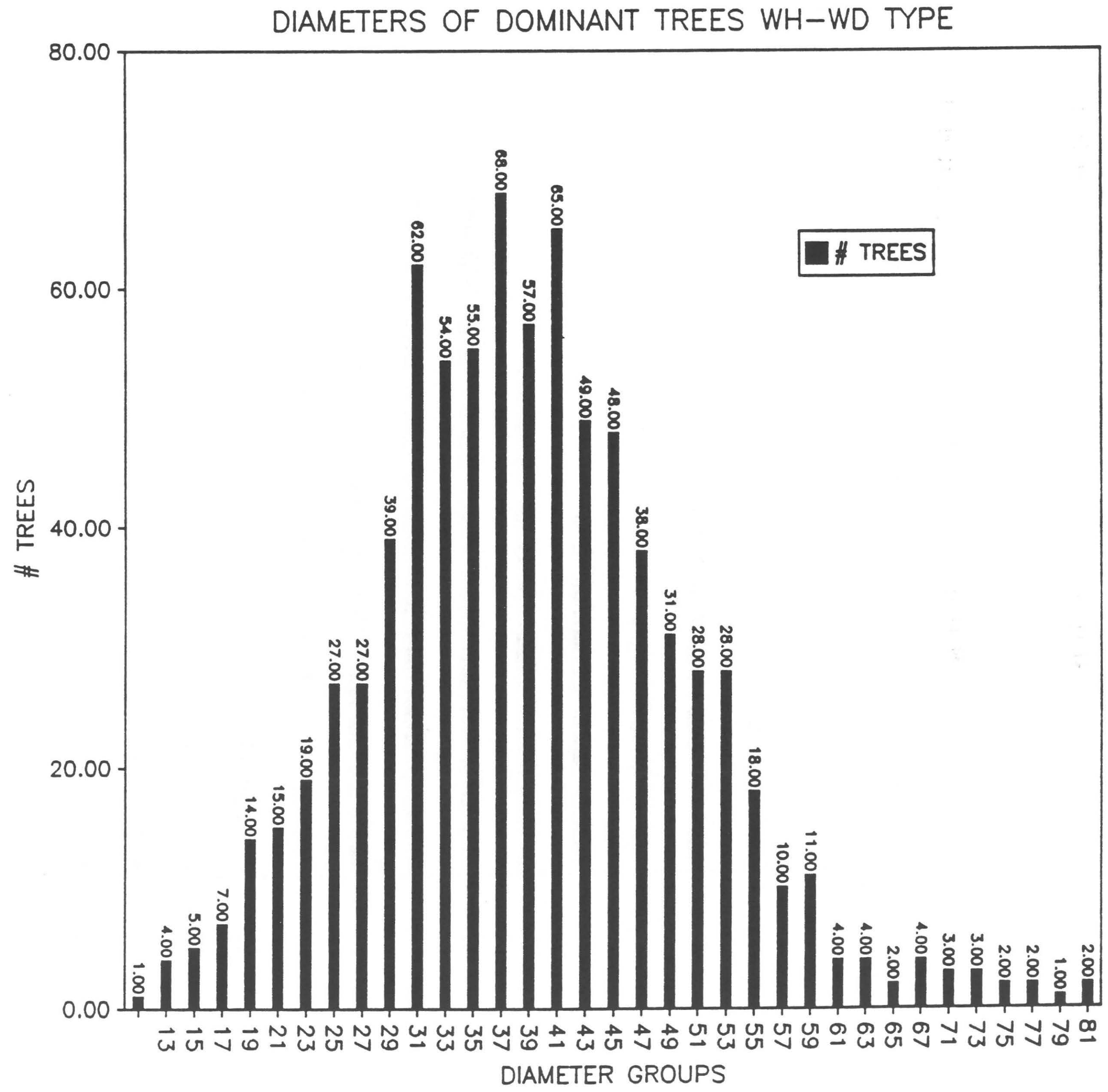
V. ANALYSIS PROCEDURES

Main Canopy - Large Trees

This attribute describes the dominant canopy of the stand, and trees recorded as occupying a dominant crown position were used as a starting point to assess this attribute. The Task Group decided that stem diameter was the best attribute for describing density and size of "large trees" by old-growth type. Tree height was examined during the process but not used as a criterion. Tree age was added as a second large tree attribute because of the revised direction of the National Old-Growth Task Group established at their December 1990 meeting. The minimum old-growth type attribute for large trees was based on a stand having a minimum density of trees greater than the minimum stem diameter and older than the minimum age. Large tree density is expressed in trees/acre.

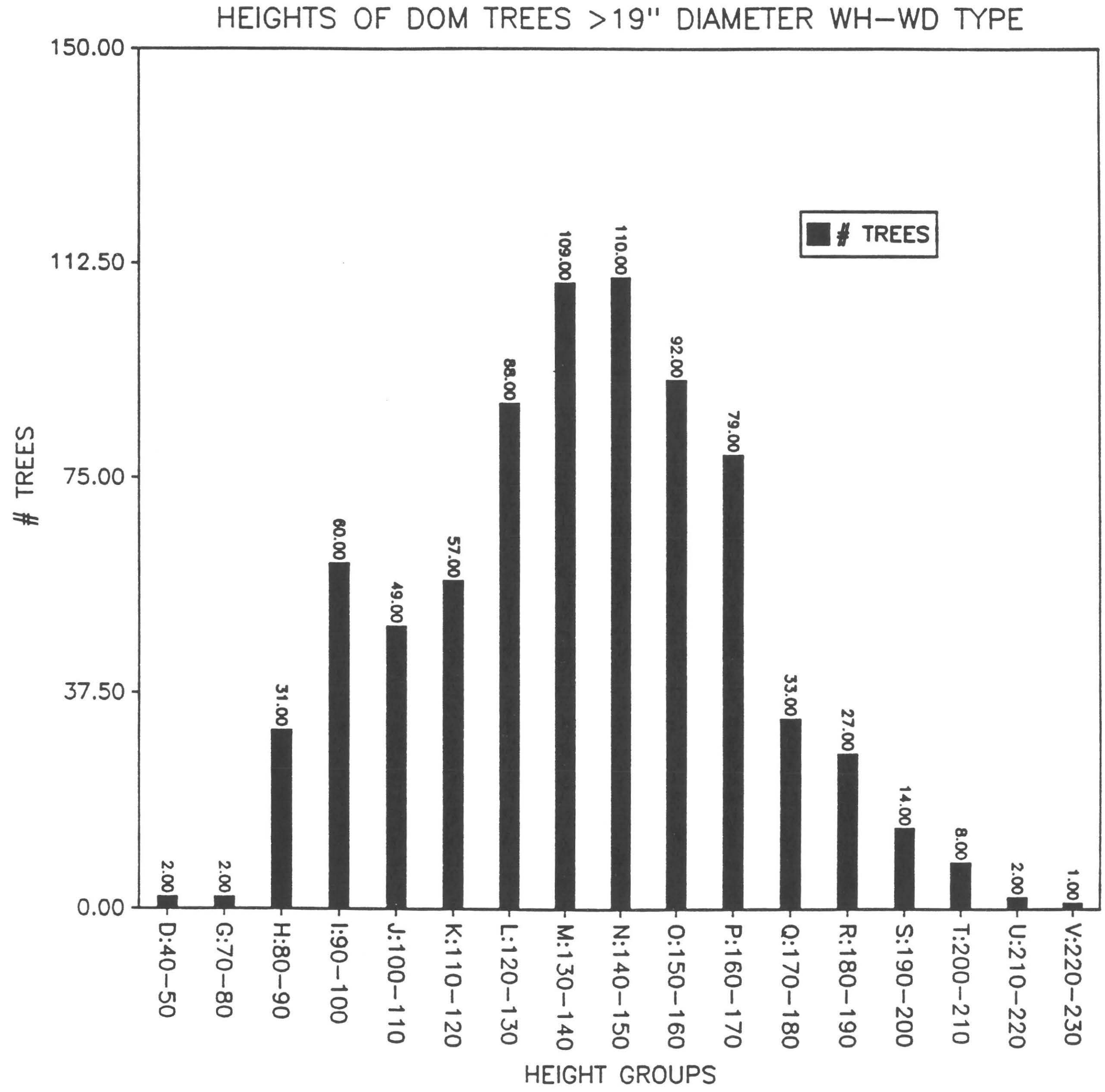
Stem Diameter and Density: Dominant trees within a stand were grouped into 2" diameter classes, and frequency distributions were plotted for each old-growth forest type. Although not specifically tested, the frequency distributions appeared to be relatively normally distributed. Stands with trees in the distribution "tails" were reviewed to ensure proper old-growth forest type classification. After classification corrections, the frequency distributions were replotted (TABLE 3). "Tail" values remaining after plot classification corrections were identified as younger/smaller isolated trees that had been classified as occupying a dominant crown position due to their location. The frequency distributions were felt to reflect the inherent tree size variation of temperate rain forest ecosystems.

TABLE 3-Diameter Distribution



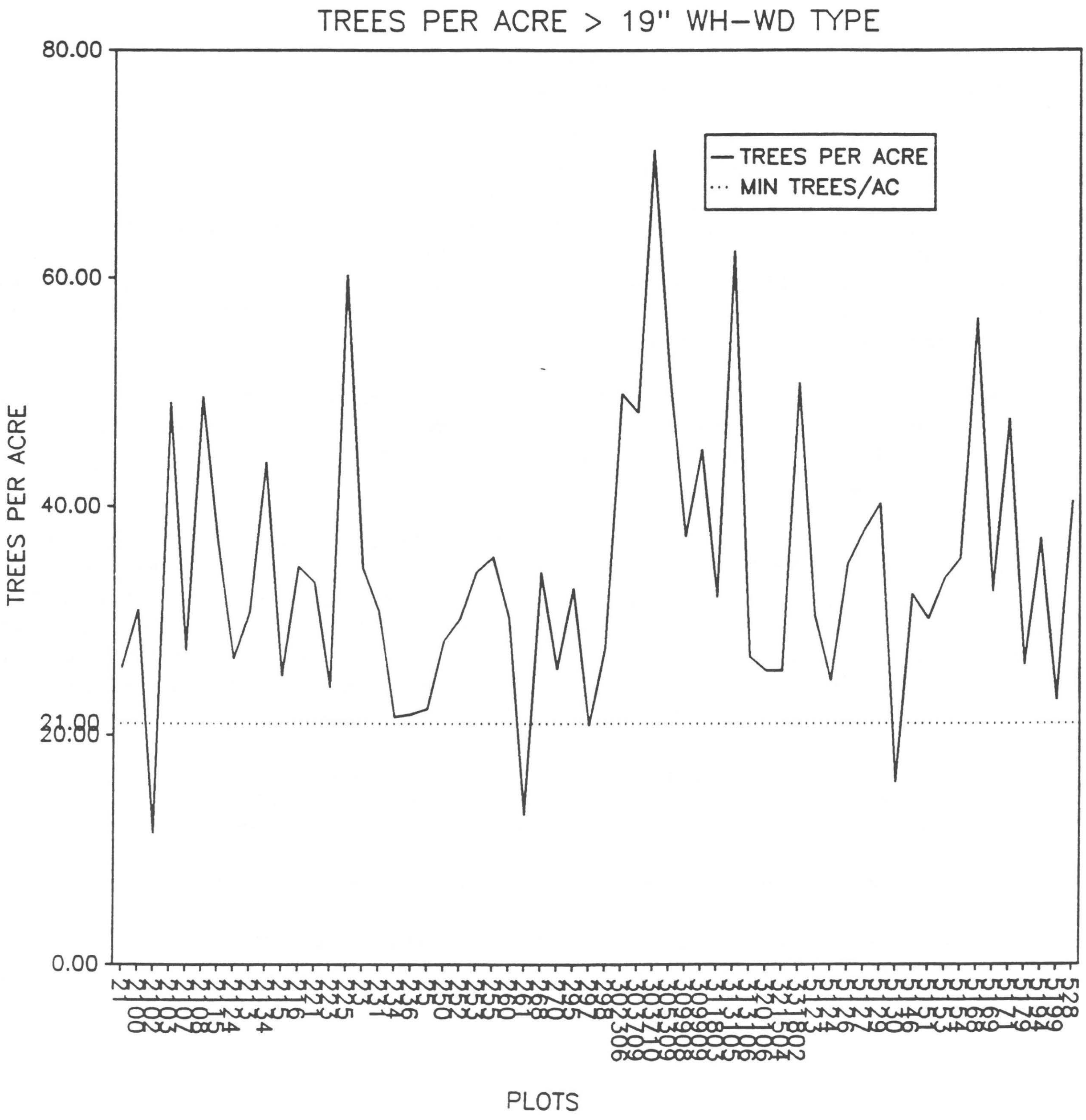
Height: Dominant tree were grouped into height classes (10' height groups) and a similar procedure as for diameters was followed to ensure proper old-growth forest type classifications of data set stands. This analysis provided additional height frequency distribution information (see TABLE 4), and gives a general illustration of where "most" tree heights within the type occur.

TABLE 4-Height Distribution



An initial minimum stem diameter for defining large trees for each old-growth type was selected by examining the point on the left side of the frequency distribution where the frequencies began to increase rapidly. The density of trees with a stem diameter greater than or equal to the initial minimum value was summarized by stand for each old-growth type. This process was repeated increasing and decreasing the minimum stem diameter and plotting the corresponding shifts in the density of large trees (see TABLE 5).

TABLE 5-Large Trees/ac by Plot



The Task Group reviewed these outputs and established a suitable minimum large tree diameter and density for each old-growth forest type using the following criteria:

-At least 90% of the stands in the data set should meet the minimum criteria for large trees; and

-Plots with an average of less than 2 trees larger than the minimum diameter per sample point or with an abnormally low number of sample trees for the type were excluded. These plots had probably had recent wind throw or other disturbances and would not reflect an accurate tree density for the type.

Stem diameter, large tree density, and height group frequency distributions for all old-growth forest types can be found in Appendix D.

Age: Minimum age of the large trees was added as a National standard old-growth attribute at the December 1990 National Old-Growth Task Group meeting. Tree age should not be confused with stand age.

** There needs to be a clear distinction that age is used as a second criteria for the large trees and is **not necessarily relevant** to overall stand age. **

The Region 10 Task Group felt comfortable defining functional old-growth without a tree or stand age criteria. If the functioning components (ie. large trees, decadence, snags, down material, crown structure, etc.) are present, a functioning old-growth ecosystem exists regardless of its age. A minimum age of large trees is included to meet National definition standards, however, it is considered secondary in importance to having all functional components in an old-growth stand.

Due to the extreme variation in tree age for a given tree size in Southeast Alaska ecosystems (e.g. 56 to 308+ years of age for trees 19" diameter in the western hemlock-well drained old-growth type), it was extremely difficult to use the data to generate a meaningful large tree age. Therefore, several methods of determining minimum large tree age were explored.

A literature review and consultation with the Forest Sciences Lab (Juneau, AK) indicated the Taylor (1934) study could provide information as to the age at which stands began to develop old-growth characteristics under natural conditions. This study sampled 288 plots of second-growth Sitka spruce-western hemlock stands of varying site quality throughout Southeast Alaska. The Taylor study provides an estimation of the age trees grow to various sizes after natural disturbances and the development of stand characteristics over time. Old-growth forest types were correlated to Taylor's site index values based upon growth potential, and various values (Table 6) were extracted from Taylor's report. This information includes:

1. When mortality exceeds in-growth (reduction in trees/ac).
2. When the stand would have the minimum number of large trees per acre.
3. When stand growth begins to decline (mean annual increment peaks and stand decadence begins).
4. When the average stand diameter exceeds the minimum large tree diameter.

Taylor's information suggests that trees will grow to the minimum diameter size at a fairly young age (70-90 years) for all types. The highest large tree ages Taylor's information indicated (average stand age meeting the minimum diameter) were 140-150 years for all types.

Weaknesses for using Taylor's information for absolute values include:
-It is for second-growth stands developing naturally after disturbances.
-It reflects stand development information as opposed to single tree information.

The Timber Inventory data set was explored for large tree age using two methods.

1. The first method was to list ages of minimum diameter trees by old-growth type and determine the age which at least 90% and 95% of these individual trees attained that size under natural "old-growth" conditions. This method verified Taylor's information that trees will grow to the minimum diameter at a relatively young age. Also,it verifies that large trees of a relatively young age exist on all our old-growth types because of the high amount of natural stand variation. Minimum old-growth type ages for large trees using this method range from 80-150 years for 95% of the trees and 100-165 years for 90% of the trees.(Table 6)

2. The second method was to use a sensitivity analysis to determine when age as an additional criteria would begin to reduce the large tree per acre value the Task Group had established prior to consideration of age.(Table 6)

Upon evaluating each of these tree age analysis methods, it was decided the plot sensitivity analysis would be the most appropriate method to use to establish values for the large tree minimum age criteria.

TABLE 6 - Large Tree Age Analysis

	TAYLOR'S INFORMATION				TIMBER INVENTORY		
OLD-GROWTH FOREST TYPE	AGE MORTALITY REDUCES TREES/AC	AGE STAND HAS MIN # LARGE TREES/AC	AGE STAND MAI PEAKS & DECADENCE BEGINS	AGE AV. STAND DIA> MIN LARGE TREE DIA	AGE OF 95% OF SAMPLE TREES	AGE OF 90% OF SAMPLE TREES	PLOT SENSI-TIVITY METHOD *
SS-AL	50	90	80	145	110	125	**260**
SS-O	60	70	90	150	130	165	**160**
WH-WD	60	90	100	140	80	105	**150**
WH-PD	80	90	120	140	90	100	**180**
WH/WRC-WD	60	90	100	140	150	160	**170**
WH/WRC-PD	70	90	110	150	130	150	**150**
WH/AC	80	90	120	140	120	130	**150**
MIX CON	120	90	140	140	100	110	**170**
MTN HEM	80	90	120	140	90	100	**160**
SHOREPINE	120	90	140	140	120	130	**170**

* Minimum large tree ages.

Decadence: The number of decadent large trees per acre was also an attribute added at the December 1990 National meeting.

This value was generated by summarizing the density (trees/acre) with damages that would indicate dead or deformed tops, stem deformities or decay. (see Appendix C for damage codes used to generate this value)

Canopy and Stand Structure

This ecological attribute addresses within-stand structural variation. The number of canopy layers indicates vertical structural diversity and the number of diameter classes represents size class variation. In the Alaska Region, stand diversity is further represented by the presence of particular forbs which result from a discontinuous canopy (see **Forbs**.).

Canopy Layers: To assess canopy layers the data was analyzed using canopy layer definitions found in Forest Service data standards literature (Proposed Service-Wide Data Standards for Vegetation Information, 1989). These standards define five(5) possible forest layers. Up to three(3) tree canopy layers, a shrub layer and a herb/forb layer. The definitions for tree canopy layers are:

Layer 1: Trees whose height is over 70% of the main canopy (Dominants & Codominants).
Layer 2: Trees whose height is 40-69% of the main canopy (Dominants & Codominants).
Layer 3: Trees whose height is 0-39% of the main canopy (Dominants & Codominants).

This attribute is further defined that at least five(5) trees per acre must be present to be considered a canopy layer. The minimum number of canopy layers for each type was defined as the lowest canopy layer represented on 10% or more of the plots for a given type.(See Table 7)

TABLE 7 - Canopy Layers

OLD-GROWTH FOREST TYPE	# PLOTS REPRESENTED BY CANOPY LAYER			MINIMUM # OF CANOPY LAYERS
	3 LAYERS	2 LAYERS	1 LAYER	
SS-AL	9	9	2	2
SS-O	24	9	1	2
WH-WD	67	6	0	3
WH-PD	49	9	1	2
WH/WRC-WD	36	1	0	3
WH/WRC-PD	26	2	0	3
WH/AC	82	6	0	3
MIX CONIFER	105	7	0	3
MTN HEM	98	14	7	3
SHOREPINE	7	2	0	2

Diameter Classes: The number of diameter classes was an attribute added at the December 1990 National Old-Growth Task Group meeting. It is defined as the number of 2" diameter classes present on at least 95% of the plots. At least five(5) trees per acre must be present to represent a diameter class.

The number of 2" diameter classes on each plot within a type was determined. The frequency of plots with different diameter classes was then charted (see Table 8). The minimum number of diameter classes was determined such that 90-95% of the plots would meet this criteria.

TABLE 8 - Frequency of Plots Having Different Diameter Groups

OLD-GROWTH FOREST TYPE	PLOT DISTRIBUTION BY TYPE AND BY NUMBER OF DIAMETER GROUPS PRESENT													MINIMUM # OF DIAMETER GROUPS AND % OF PLOTS MEETING THIS CRITERIA
SS-AL	1	**2**	3	3	3	2	1	2	1	1	1	0	0	**2** -- 95%
SS-O	0	2	**2**	1	3	4	6	11	3	3	0	0	0	**3** -- 94%
WH-WD	1	3	0	**5**	6	19	15	12	6	5	0	1	1	**4** -- 94%
WH-PD	0	0	3	**5**	2	9	16	10	8	3	2	1	0	**4** -- 95%
WH/WRC-WD	0	0	1	0	1	**3**	4	15	10	3	0	0	0	**6** -- 94%
WH/WRC-PD	0	0	0	1	0	**3**	2	7	8	4	3	0	0	**6** -- 96%
WH/AC	0	2	2	**4**	4	11	22	19	12	7	5	1	0	**4** -- 95%
MIX CONIFER	1	4	**10**	14	18	25	18	15	6	0	1	0	0	**3** -- 96%
MTN HEM	2	7	**10**	12	15	16	20	24	9	4	0	0	0	**3** -- 92%
SHOREPINE	1	**1**	4	3	1	0	0	0	0	0	0	0	0	**2** -- 90%
	1	2	3	4	5	6	7	8	9	10	11	12	13	# OF DIAMETER GROUPS

Snags

A snag is defined as a standing dead tree. To differentiate between a standing snag and a piece of down material, the Task Group decided a dead tree would be considered a snag if it was standing on its own with no support, regardless of amount of lean. A dead tree receiving support will be considered a piece of down material.

Minimum Snag Diameter: Minimum snag diameters were set at the same size as large trees by type.

Minimum Snag Height: A dead tree needed to be at least ten (10) feet in height to be considered a snag (Wildlife Habitats in Managed Forests, Thomas 1989).

Snag Density: Calculation of snag density (#/acre) was accomplished very similar to the large trees per acre value. However, the snags per acre value is less reliable. The timber inventories recorded only dead trees that contained a minimum amount of merchantable volume, and did not specify if the tree was standing or down. While the inclusion of some merchantable down material may be artificially raising the number of snags per acre, there are likely several more snags in actuality that did not contain merchantable volume and were not recorded. Therefore, the Task Group decided to adjust the number of snags per acre derived from the data set up by one(1) for all types. The density of snags per acre was further adjusted for the Sitka spruce-alluvial type up to two(2) and for the Sitka spruce-other type down to one(1) on the November 5 Task Group field verification trip.

Decay Classes: Decay classes were defined using standards from the USDA Forest Service Proposed Service-wide Data Standards for Vegetation Information, June 1989. Decay classes are:

..1..Branches, twigs, bark intact (hard)
..2..Loose bark, secondary branches gone (hard)
..3..Bole clean (hard)
..4..No bark or branches, top broken (soft)
..5..Broken top, bole decomposed (soft)

Decay classes 1,2, and 3 were grouped to represent "young" snags and classes 4 and 5 to represent "older" snags. The Task Group determined that a functional old-growth system should have representation from both of these decay categories. It was agreed that at a minimum one(1) snag per acre of each of these groupings needed to be present to meet the decay class attribute.

Down Material

Density and Size: Data describing down material was limited to the 1984 Multi-resource Forest Inventory data set and the Plant Association plots. Neither inventory collected information on number of pieces by size, and therefore were unusable to satsfactorily generate values for this attribute.

The minimum piece size requirements were set at the diameter of the large trees, and at least 10' in length. This is consistent with the snag minimum sizes. These minumums and the number of pieces per acre were established by consensus using the professional judgement of the Task Group.

Decay Classes: Decay classes were again defined using data standards from the USDA Forest Service Proposed Service-wide Data Standards for Vegetation Information, June 1989.

Decay Classes are:

1. Tree live, leaves green
2. Fresh killed, needles or leaves still on
3. Recent dead, bark intact, limbs present, texture mostly sound, round shape, wood original color, elevated on support points.
4. Intermediate, bark loose, limbs missing, sapwood decay present round shape, wood original to faded color, support-all to mostly sagging.
5. Decomposing, bark absent, branch stubs loose, round to oval shape, color faded, all pieces on ground.
6. Decomposed, wood has deteriorated to punk or tinder.

As with snags, decay classes 1,2, and 3 were grouped to represent "young" down material and classes 4,5, and 6 were grouped to represent "older" down material. Again, it was agreed that at least one(1) piece per acre from each group is needed to meet this attribute, with the Shore Pine type as an exception. Observation of the short stature Shore Pine type indicates that most down pieces are the result of dead trees falling over from decomposition instead of windthrow. Therefore, this material is "older" in nature when it first becomes down material. This was discussed on the November 5 field verification trip and was agreed that for down material on the Shore Pine type, two(2) pieces per acre of any decay class is appropriate.

Forbs

This ecological attribute may be the best indicator of horizontal diversity for Southeast Alaska. The approach taken was to consider plants whose presence would be limited or eliminated in a non old-growth situation. Shrubs were not considered as they are poor indicators for this reason. The number of species per se is also not a good indicator in itself. Therefore, the presence of a specified level of any assemblage of plants was considered to be the best approach. It was agreed the "Forb" definition would be all forbs except grasses, sedges, ferns, skunk cabbage and deer cabbage.

Canopy Cover: The plant association plots were analyzed for forb plants to determine frequency and level of presence. The percent frequency was discussed at the November 2 Task Group meeting. Percentages were set for each type at a level such that most plots were included.

It was determined that due to the natural open grown situation, forb cover was not a valid old-growth attribute on the Mixed Conifer and Shore Pine types. Therefore, this attribute will not be applicable to those types. This attribute is also waived on one plant association (WH/WRC-SWORD FERN) in the Western Hemlock/Western Redcedar-Well Drained old-growth type.

VI. QUALITATIVE SCALE FOR OLD-GROWTH "VALUE"

Attempts are being made in some areas of the country to use the relative amount of old-growth attributes present in a stand to assign the old-growth stands relative value. While this concept has application, particularly at the project planning level, the Task Group did not feel adequate information is available for Southeast Alaska to make these value judgements at this time.

The Region 10 definitions are designed as minimum attribute definitions with all attributes described on the Inventory Matrix required to be present on the stand as a whole for that stand to be considered as "functional old-growth".

The Task Group felt the best approach was to apply the newly developed minimum attribute definitions while keeping the qualitative scale concept as an option for update as information becomes available through validation and inventory processes.

VII. VALIDATION NEEDS

The Task Group considers development of old-growth definitions dynamic with flexibility for updating as additional or improved information is available.

These definitions were developed primarily through the analysis of existing information that was collected for purposes other than old-growth definition development. Therefore, field validation should be considered as an important next step. Several possible methods of validation were discussed by the Task Group. The primary validation method recommended was to monitor application of these definitions during existing data collection activities such as stand exams or installation of additional plant association samples.

The Region 10 silviculture information system has incorporated old-growth definition attributes for storage of this information by stand. Appendix E includes a sampling card the Chatham Area developed to better integrate data collection. It includes elements necessary to assess old-growth condition.

It is recommended that at least the elements pertaining to old-growth attributes be incorporated into the stand exam and plant association sampling procedures with information storage in the silviculture information system for definition validation use. Old-growth definitions should be incorporated into the design of future inventories and any updating from the validation process should be accomplished prior to implementation of those inventories.

VIII. INVENTORY NEEDS

The Task Group brainstormed a potential list of items to consider during future inventory design that could play a role in old-growth management:

-Crown closure, understory composition and lichens
-Stand size and within stand variation
-Old-growth quality scale information
-Old tree character(limb size, crown structure, etc. Other than damage)
-Snag & down wood information (angle of lean, is it on the ground, with or across slope orientation)

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APPENDICIES

APPENDIX A........	Cross Reference of Society of American Foresters Forest Cover Types to Region 10 Old-Growth forest types to Region 10 plant associations
APPENDIX B........	Old-growth forest type narratives
APPENDIX C........	Data table and codes used in analysis
APPENDIX D........	Graphs of Old-growth forest type diameter, height, and tree per acre distributions
APPENDIX E........	Sample Old-growth data collection cards

APPENDIX A

CROSS REFERENCE OF SOCIETY OF AMERICAN FORESTERS FOREST COVER TYPES
TO
REGION 10 OLD-GROWTH TYPES
TO
REGION 10 PLANT ASSOCIATIONS

SAF COVER TYPE #223-SITKA SPRUCE
R-10 OLD-GROWTH FOREST TYPE: *SITKA SPRUCE-ALLUVIAL*

PA CODE	AREA PRESENT	PA ABBREVIATION	COMMON PLANT NAME
320	ALL	PISI/VACCI-OPHO	/vaccinium-devils club
330	ALL	PISI/OPHO	/devil's club
335	CA,KA	PISI/OPHO-RUSP	/devil's club-slamonberry
340	ALL	PISI/OPHO/LYAM	/devil's club/skunk cabbage
350	ALL	PISI/ALNUS	/alder
351	SA	PISI/ALNUS/OPHO	/alder/devil's club
352	ALL	PISI/ALRU	/red alder
353	CA	PISI/ALSI	/Sitka alder
370	ALL	PISI/VACCI/LYAM	/blueberry/skunk cabbage
380	KA	PISI/RUSP	/salmonberry

SAF COVER TYPE #223-SITKA SPRUCE
R-10 OLD-GROWTH FOREST TYPE: *SITKA SPRUCE-OTHER*

PA CODE	AREA PRESENT	PA ABBREVIATION	COMMON PLANT NAME
310	ALL	PISI/VACCI	/blueberry
345	CA	PISI/OPHO-Upland	/devil's club-Upland
355	SA	PISI/OPHO/CIAL	/devil'sclub/enchanters nightshade
360	CA,KA	PISI/CANU	/Pacific reedgrass
395	SA	PISI-TSME /VACCI-OPHO	-mountain hemlock /blueberry-devil's club

APPENDIX A (continued)

SAF COVER TYPE #224-WESTERN HEMLOCK
R-10 OLD-GROWTH FOREST TYPE: ***WESTERN HEMLOCK-WELL DRAINED***

PA CODE	**AREA PRESENT**	**PA ABBREVIATION**	**COMMON PLANT NAME**
120	ALL	TSHE/VACCI/DRAU	/blueberry/shield fern
140	ALL	TSHE/VACCI-OPHO	/blueberry/devil's club
155	KA	TSHE/OPHO-RUSP	/devil's club-salmonberry
160	CA,SA	TSHE/OPHO	/devil's club

SAF COVER TYPE #224-WESTERN HEMLOCK
R-10 OLD-GROWTH FOREST TYPE: ***WESTERN HEMLOCK-POORLY DRAINED***

PA CODE	**AREA PRESENT**	**PA ABBREVIATION**	**COMMON PLANT NAME**
110	ALL	TSHE/VACCI	/blueberry
130	ALL	TSHE/VACCI/LYAM	/blueberry/skunk cabbage
150	CA	TSHE/OPHO-Shallow Soils	/devil's club-Shallow Soils
170	CA	TSHE/OPHO/LYAM	/devil's club/skunk cabbage

SAF COVER TYPE #227-WESTERN RED CEDAR-WESTERN HEMLOCK
R-10 OLD-GROWTH FOREST TYPE: ***WESTERN HEMLOCK/WESTERN RED CEDAR-WELL DRAINED***

PA CODE	**AREA PRESENT**	**PA ABBREVIATION**	**COMMON PLANT NAME**
710	KA,SA	TSHE-THPL/VACCI	/blueberry
720	KA	TSHE-THPL/POMU	/swordfern
750	KA	TSHE-THPL/VACCI -well drained soils	/blueberry-well drained

APPENDIX A (continued)

SAF COVER TYPE #227-WESTERN RED CEDAR-WESTERN HEMLOCK
R-10 OLD-GROWTH FOREST TYPE:*WESTERN HEMLOCK/WESTERN REDCEDAR-POORLY DRAINED*

PA CODE	AREA PRESENT	PA ABBREVIATION	COMMON PLANT NAME
730	KA,SA	TSHE-THPL/VACCI/LYAM	/blueberry/skunk cabbage
760	KA	TSHE-THPL/VACCI-GASH	/blueberry/salal
765	KA	TSHE-THPL/VACCI-GASH	/blueberry/salal/skunk cabbage
780	KA	TSHE-THPL/GASH	/salal

SAF COVER TYPE #227-WESTERN RED CEDAR-WESTERN HEMLOCK
R-10 OLD-GROWTH FOREST TYPE: *WESTERN HEMLOCK/ALASKA-CEDAR*

PA CODE	AREA PRESENT	PA ABBREVIATION	COMMON PLANT NAME
210	ALL	TSHE-CHNO/VACCI	/blueberry
220	ALL	TSHE-CHNO/VACCI	/blueberry/skunk cabbage
230	CA	TSHE-CHNO/VACCI-MEFE	/blueberry-rusty menziesia
250	CA,KA	TSHE-CHNO/VACCI-OPHO	/blueberry/devil's club

SAF COVER TYPE #228-WESTERN RED CEDAR
R-10 OLD-GROWTH FOREST TYPE: *MIXED CONIFER*

PA CODE	AREA PRESENT	PA ABBREVIATION	COMMON PLANT NAME
410	ALL	MXD CON/VACCI	/blueberry
420	ALL	MXD CON/VACCI/LYAM	/blueberry/skunk cabbage
430	ALL	MXD CON/VACCI/FACR	/blueberry/deer cabbage
440	CA	MXD CON/LYAM-ATFI	/skunk cabbage-lady fern
460	KA,SA	MXD CON/VACCI-GASH	/blueberry/salal
470	SA	MXD CON/GASH/LYAM	/salal/skunk cabbage
480	KA	MXD CON/GASH	/salal
490	CA	MXD CON/CLPY	/copper bush

APPENDIX A (continued)

SAF COVER TYPE #205-MOUNTAIN HEMLOCK
R-10 OLD-GROWTH FOREST TYPE: *MOUNTAIN HEMLOCK*

PA CODE	AREA PRESENT	PA ABBREVIATION	COMMON PLANT NAME
510	ALL	TSME/VACCI	/blueberry
511	CA	TSME-PISI/VACCI	-Sitka spruce/blueberry
515	KA	TSME/VACCI-Low Elev	/blueberry-Low Elevation
520	CA	TSME/CLPY-CASSI	/copper bush-Cassiope spp.
530	ALL	TSME/CASSI	/Cassiope spp.
540	KA,SA	TSME/VACCI-CLPY/FACR	/blueberry-copper bush/deer cabbage
550	KA	TSME-CHNO/VACCI	-Alaska-cedar/blueberry
560	KA	TSME-CHNO/VACCI-CLPY/FACR	-Alaska-cedar/blueberry-copper bush/deer cabbage
570	SA	TSME/VACCI/CABI	/blueberry/march marigold
580	SA	TSME/VACCI/LYAM	/blueberry/skunk cabbage

SAF COVER TYPE #218-LODGEPOLE PINE
R-10 OLD-GROWTH FOREST TYPE: *SHORE PINE*

PA CODE	AREA PRESENT	PA ABBREVIATION	COMMON PLANT NAME
610	ALL	PICO/EMNI	/crowberry
620	SA	PICO/VACCI	/blueberry
630	SA	PICO/CASI	/Sitka sedge
630	CA	PICO/TALL SEDGE	/tall sedge

APPENDIX B

OLD-GROWTH FOREST TYPE NARRATIVES

Appendix B contains a brief narrative for each of the Region 10 old-growth forest types. These narratives are intended to provide subjective information that will aid understanding differences between the types and some of the more important functions and resource inter-actions occurring within each of the types. A more detailed discussion of ecological relationships and plant associations can be found in DeMeo (1989), Martin (1985,1989), and Pawuk and Kissinger (1989).

SITKA SPRUCE-ALLUVIAL OLD-GROWTH FOREST TYPE

This type is abundant throughout Southeast Alaska below 1700 feet elevation. Most stands occur on floodplains or alluvial fans below 850 feet elevation. This type is usually associated with riparian ecosystems.

General Description

Sitka spruce dominates the stand with western hemlock, red alder, and cottonwood occurring. Stands are relatively open grown with tree canopy cover typically ranging from 30 to 60%. This type is typically multi-layered, with mid canopy layer trees growing in the open, and contains very large and tall spruce. The height of the upper canopy often ranges from 100 to 130 feet and large tree diameters often range from 35 to 51 inches. Trees have been recorded exceeding 200 feet in height and diameters up to 81 inches on the best sites. Large trees have been recorded as young as 110 years, however, most large trees sampled(more than 90%) exceeded 140 years of age.

Tall shrub cover (salmonberry and devil's club) dominates the ground vegetation, often exceeding 60% cover. Forb cover (deerberry, trifoliate foamflower, and skunk cabbage) is moderate. Soils are deep, generally well drained, with very thin organic layers. Soil disturbance through flooding is frequent and restricts soil profile development. The thin organic layers are easily disturbed which favors re-establishment of salmonberry, devils club or alder.

Many large spruce develop heart rots and break off prior to dying, therefore snags, while large, are not abundant. Natural regeneration of spruce is sporadic and usually occurs only on microsites. Down material as "nurse logs" is critical to conifer regeneration.

Ecological Relationships

Windthrow and stream channel meandering are common disturbance forces in this type.

This forest type is usually associated with riparian habitats where it provides bank stability, cover, and woody material input into streams. Devilsclub, currant, and salmonberry fruit production is relatively high. Snags, though few in number, tend to be large and can provide excellent habitat for cavity dwellers.

APPENDIX B (continued)

SITKA SPRUCE-OTHER OLD-GROWTH FOREST TYPE

This old-growth type can be found throughout Southeast Alaska below 1500 feet elevation. Soils are generally deep, mineral, and well drained. Most stands occur on colluvial foot slopes below 500 feet elevation. This old-growth type includes two distinct ecological communities that were combined for inventory definition purposes. These are the upland spruce plant associations and the spruce-reedgrass associations that generally occur as beach fringes.

General Description

Sitka spruce and western hemlock dominate the overstory of old-growth stands, with other tree species occurring in small amounts. Tree canopy cover often ranges from 70 to 80%, is typically multi-layered, and contains large branched, deep crowned hemlock and spruce. Western hemlock is the dominant understory tree. The height of the upper canopy often ranges from 80 to 130 feet and large tree diameters often range from 27 to 43 inches. Trees have been recorded exceeding 200 feet in height and diameters up to 79 inches on the best (upland) sites. Large trees have been recorded as young as 106 years, however, most large trees sampled(more than 90%) exceeded 165 years of age.

Shrub cover (blueberry and devil's club) is moderate (40-50%) and forb cover (five leaf bramble, bunchberry dogwood, shield, lady, and oak ferns) often exceeds 30%. Sword fern is common on the southern third of southeast Alaska.

Down woody material is large and abundant originating from both windthrow and tree breakage. Decomposition rates are relatively faster on these sites than the organic soil sites.

Ecological Relationships

Disturbance patterns are quite different for the two major plant groups of this type. The reedgrass associations are subject to severe storm and salt spray while the upland sites are associated with steep terrain, soil and snow movement. Natural regeneration of spruce and hemlock can be dense.

Wildlife use within this type is strongly dependant upon landscape position. Reedgrass sites may provide habitat for species associated with the coastline. On upland sites, snags are often few in number, but tend to be large and can provide excellent habitat for cavity dwellers.

APPENDIX B (continued)

WESTERN HEMLOCK-WELL DRAINED OLD-GROWTH FOREST TYPE

This type is common throughout Southeast Alaska below 1500 feet elevation on deep well drained soils. Most stands occur on colluvial foot slopes.

General Description

Western hemlock dominates the overstory and understory. Other tree species may occur in small amounts. Tree canopy cover often ranges from 70 to 80%, is multi-layered, and contains large branched, deep crowned hemlocks. The height of the upper canopy often ranges from 120 to 160 feet and large tree diameters often range from 31 to 41 inches. On the very best sites, trees can exceed 200 feet in height with diameters up to 80 inches. Large trees have been recorded as young as 56 years, however, most large trees sampled(more than 90%) exceeded 105 years of age.

Shrub cover (blueberry and devil's club) is usually moderate (40-50%) and forb cover (five leaf bramble, bunchberry dogwood, and shield, lady, and oak ferns) often exceeds 30%. On devil's club sites, herbaceous vegetation is abundant. Sword fern is common on this type in the southern third of Southeast Alaska. Salal does not occur.

Down woody material is large and abundant originating from both windthrow and tree breakage. Decomposition rates are relatively faster on these sites than the organic soil sites.

Ecological Relationships

Windthrow is a common disturbance element in this group. It can occur both as single tree events and as catastrophic events.

Natural regeneration of spruce and hemlock following disturbance is often dense. Under natural disturbance regimes, stand closure often occurs between age 30-40. Under these dense closed canopy situations, moss can dominate the understory to at least age 100. By age 150 shrubs may become established in the understory.

If mineral soil is exposed, red alder is likely to dominate the site for at least 50 years. Sitka alder will dominate exposed soils on northern Chichagof Island.

Large spruce and hemlock trees can effectively intercept snow on this type. Understory vegetation is relatively abundant and generally available for forage during winter. Large standing trees provide good nest and forage sites for cavity dwellers. Large down woody material and elevated root systems are often present and can provide good forage, resting and denning sites for a variety of wildlife.

APPENDIX B (continued)

WESTERN HEMLOCK-POORLY DRAINED OLD-GROWTH FOREST TYPE

The Western Hemlock-Poorly Drained Old-Growth type is abundant throughout Southeast Alaska below the mountain hemlock zone. This type is a result of poorly drained soil similar to the Alaska-cedar type, however it often occurs in smaller patches and at a lower elevation (less than 500'). This type often occurs on steeper slopes than the mixed conifer type.

General Description

Western hemlock is the dominant overstory and understory tree of old-growth stands, with other tree species occurring in small amounts. Tree canopy cover often ranges from 50 to 70%, is multi-layered, and has large branched, deep crowned trees. Tree crowns do not achieve the massive stature in this type that occurs on the Well Drained Western Hemlock type. The height of the upper canopy often ranges from 80 to 110 feet and large tree diameters often range from 27 to 31 inches. Large trees have been recorded as young as 65 years, however, most large trees sampled(more than 90%) exceeded 100 years of age. Young stands can contain a significant component of Sitka spruce which often appears stressed (yellowing needles) due to wet soil - low nutrient conditions. Arboreal lichens occur less than on the mixed conifer type but more than on closed canopy sites.

Shrub cover (blueberry and rusty menziesia) is usually moderate (40-60%) and forb cover (skunk cabbage, five leaf bramble, and bunchberry dogwood) is usually less than 30%, except on skunk cabbage sites where it may exceed 75%. Salal is common on these sites as a co-dominant with blueberry on the islands in the southern one-third of Southeast Alaska. Shield fern, common on well drained sites, is nearly absent in this type.

Down woody material is abundant, and medium sized. Due to low decomposition rates cedar logs and snags accumulate on these sites. Cedar die-back reported by Hennon is common in this type. Down wood is important for tree regeneration sites skunk cabbage associations.

Ecological Relationships

Windthrow is a common disturbance element in this group.

This type provides a more interior forest condition than the open grown types. However, interior forest conditions like those found in better drained types generally does not occur.

The relatively open canopy structure of this type allows more light and snow to reach the forest floor. A shrub component is often present and may be available as forage during low snow conditions. Lichen, berry and seed production is intermediate between the closed-canopy and more open-canopy types.

Hemlock snags are generally smaller diameter than on well-drained sites, but still provide roosting and foraging habitat for cavity dwellers.

APPENDIX B (continued)

WESTERN HEMLOCK/RED CEDAR-WELL DRAINED OLD-GROWTH FOREST TYPE

This type is found in southern Southeast Alaska below 1000 feet elevation.
Most stands are found on deep, well drained mineral soils (colluvial foot slopes) below 500 feet elevation.

General Description

Western hemlock and red cedar co-dominate the overstory with other tree species occurring in small amounts. Tree canopy cover often ranges from 70 to 80%, is multi-layered, and contains large branched, deep crowned hemlocks and cedar. Western hemlock dominates the understory. The height of the upper canopy often ranges from 100 to 150 feet and large tree diameters often range from 25 to 39 inches. On the very best sites, trees have been recorded exceeding 200 feet in height and diameters up to 89 inches. Large trees have been recorded as young as 143 years, however, most large trees sampled(more than 90%) exceeded 160 years of age.

Shrub canopy cover (rusty menziesia, blueberry and devil's club) is usually moderate (40-50%) with forb cover(primarily five leaf bramble & bunchberry dogwood) often exceeding 30% in old-growth stands. Shield, lady, and oak ferns are common. Sword fern is often found on these sites in the southern third of Southeast Alaska. Salal does not occur.

Down material is large and abundant originating from windthrow and tree breakage. Decomposition is much faster than on the wetter soils in the hemlock-cedar poor drained types. Cedar logs decompose slowly, even on these dryer soils.

Ecological Relationships

Windthrow is common in this type.

Natural regeneration of spruce and hemlock can be dense; cedar regeneration is often low. Under natural disturbance regimes, stand closure can occur between age 30-40, with moss dominating the understory to at least age 100. If mineral soil is exposed, red alder will likely dominate the site for at least 50 years. Sitka alder will dominate exposed soils on northern Chichagof Island. By age 150 shrubs will often dominate the understory.

Large hemlock and cedar trees can effectively intercept snow on this type. Understory vegetation is relatively abundant and generally available for forage during winter. Large standing trees provide good nest and forage sites for cavity dwellers. Large down woody material and elevated root systems are often present and can provide good forage, resting and denning sites for a variety of wildlife.

APPENDIX B (continued)

WESTERN HEMLOCK/RED CEDAR-POORLY DRAINED OLD-GROWTH FOREST TYPE

This type occurs generally in the southern one-half of Alaska, but appears to be more common in southern Southeast Alaska. It is more often found on islands than the mainland.

The type occurs from sea level to the mountain hemlock zone. This type contains highly variable soil structure, but all have poor drainage. Most stands occur on steeper mountain slopes compared to the mixed conifer type.

General Description

Western hemlock and red cedar often co-dominate old-growth stands. Cedar cover may range from 5 to 50% and western hemlock usually dominates the overstory. Other tree species occur in small amounts. Tree canopy cover often ranges from 50 to 70%, is multi-layered and contains large branched, deep crowned hemlocks and cedar. Western hemlock is the dominant understory tree. Cedar tree seedlings are uncommon, particularly in areas of high deer use. Young trees often appear stressed (yellowing needles) due to wet soil - low nutrient conditions. Tree crowns do not achieve the massive stature in this type that occurs on the well drained western hemlock type. The height of the upper canopy often ranges from 90 to 110 feet and large tree diameters often range from 21 to 27 inches. Large trees have been recorded as young as 76 years, however, most large trees sampled(more than 90%) exceeded 150 years of age. Cedar is long lived, outliving western hemlock trees by 4-6 times, and may exceed 1000 years old. Arboreal lichens are less abundant than on the Mixed Conifer sites but more abundant than on the closed canopy sites.

Shrub cover (blueberry and rusty menziesia) is usually moderate (40-60%) and forb cover (commonly skunk cabbage, five leaf bramble, and bunchberry dogwood) is usually less than 30%, but can exceed 75% on skunk cabbage sites. Salal is commonly co-dominant with blueberry on the islands in the southern one-third of southeast Alaska. Deer fern is the most common fern.

Down woody material is abundant, and medium sized. Due to relatively low decomposition rates, cedar logs and snags accumulate on these sites. Cedar die-back reported by Hennon is common in this type. Down wood is important for tree regeneration (nurse logs) on skunk cabbage sites.

Ecological Relationships

Windthrow is a common disturbance element in this group.

This type provides a more interior forest condition than the open grown types. However, interior forest conditions like those found in better drained types generally does not occur.

The relatively open canopy structure of this type allows more light and snow to reach the forest floor. A shrub component is often present and may be available as forage during low snow conditions. Lichen, berry and seed production is intermediate between the closed-canopy and more open-canopy types.

Snags are generally smaller diameter than on well-drained sites, but still provide roosting and foraging habitat for cavity dwellers.

APPENDIX B (continued)

WESTERN HEMLOCK-ALASKA-CEDAR OLD-GROWTH FOREST TYPE

The Western Hemlock-Alaska-cedar old-growth type occurs below the Mountain Hemlock type to sea level throughout Southeast Alaska. It is more common in central portion of Southeast Alaska and is found more on islands than the mainland. This type is similar to the Western Hemlock-Poorly Drained type but associated with "colder" sites.

This group exhibits extreme soil variation from shallow to deep, mineral to organic, and generally poorly drained. Due to the poor soil drainage and/or nutrient availability, this type typically has a less than completely closed canopy of medium stature. Stands can often be found on steeper slopes when compared to the mixed conifer type. Windthrow is common on this type.

General Description

Western hemlock and Alaska-cedar are often co-dominants on this type. Cedar overstory cover typically ranges from 5 to 50%, while a mix of other tree species may occur in small amounts. Tree canopy cover ranges from 50 to 70% and the canopy is typically multi-layered. Western hemlock is the dominant understory tree. Cedar seedlings are uncommon, particularly in areas of high deer use. Large branched, deep crowned hemlocks and cedar are common. Tree crowns do not achieve the massive stature in this type that occurs on the Well Drained Western Hemlock type. The height of the upper canopy often ranges from 90 to 110 feet and diameters (DBH) of the large trees from 21 to 31 inches. Large trees have been recorded as young as 83 years, however, most large trees sampled(more than 90%) exceeded 130 years of age. Cedar trees can exceed 1000 years old. Arboreal lichens, particularly *Alectoria* spp. are less abundant than on the mixed conifer type but more abundant than on the closed canopy types.

Shrub cover (blueberry, rusty menziesia) is usually moderate(40--60%) and forb cover (skunk cabbage, five leaf bramble, bunchberry dogwood) is usually less than 30%, but can exceed 75% on skunk cabbage sites.

Down material is abundant, and medium sized. Cedar logs and snags accumulate due to low decomposition rates on these sites. Cedar die-back reported by Hennon is common in this type. Down wood is important for tree regeneration sites in associations containing skunk cabbage. Many of the snags may be Alaska-cedar.

Ecological Relationships

Trees are relatively slow growing on this type and young trees often appear stressed (yellowing needles) due to wet soil - low nutrient conditions.

Alaska-cedar is a major component of this type. Therefore, regeneration of Alaska-cedar following disturbance is important to maintain species diversity.

The relatively open canopy structure of this type allows more light and snow to reach the forest floor. A shrub component is often present and may be available as forage during low snow conditions. Lichen, berry and seed production is intermediate between the closed-canopy and more open-canopy types.

Snags are generally smaller diameter than on well-drained sites, but still provide roosting and foraging habitat for cavity dwellers.

APPENDIX B (continued)

MIXED CONIFER OLD-GROWTH FOREST TYPE

The Mixed Conifer Old-Growth forest type occurs below the Mountain Hemlock type to sea level throughout Southeast Alaska. Due to poor soil drainage, this group typically has an open-grown low stature forest in which no single tree species expresses consistent dominance. Since poor soil drainage is a primary influence for development of this type, the type occurs on a greater variety of sites in higher rainfall areas (ie: southern Baronof Island and near Ketchikan). It is also more common on the islands than on the mainland. Most mixed conifer stands occur on gentle topography over bedrock, compact till, or ash deposits.

General Description

Mountain hemlock, red and Alaska-cedar, and western hemlock will often be co-dominants in this group stands with Shorepine and Sitka spruce occurring in small amounts. Pacific yew occurs to a minor extent on southern Prince of Wales and adjacent islands. Sitka spruce will not achieve dominance and almost always appears stressed (yellow needles) due to poorly drained soils. Tree growth is generally slow and overstory tree cover ranges from 30-50%. Canopy layers are common but often indistinguishable due to the openness of the canopy. Cedar seedlings are uncommon, however, cedars present often have large crowns and branches, and vegetative reproduction through layering is common. The height of the upper canopy often ranges from 50 to 75 feet and diameters (DBH) of the large trees from 10 to 15 inches. Large trees have been recorded as young as 60 years, however, most large trees sampled(more than 90%) exceeded 110 years of age. Alaska-cedar may exceed 1000 years old.

Shrub cover (blueberry and rusty menziesia) may exceed 80% in some stands. Forb cover (skunk cabbage, five leaf bramble, and bunchberry dogwood) is usually less than 30% but can exceed 75% on skunk cabbage sites. Deer fern is the most common fern. Sedges may dominate some of the open, wet plant associations.

Down material is relatively small. Decomposition rate is slow on these commonly wet soils. Cedar logs hundreds of years old have been excavated from deep organic soils on these sites. Snags are abundant but generally small. Cedar die-back reported by Hennon (1990) is common in this type.

Ecological Relationships

Down wood is extremely important for regeneration of all tree species on the wet soils of these sites. Because of generally low tree stature and cedar resistance to decay, windthrow is infrequent in this type. Therefore, the type contains an abundance of snags. As soils are deep, organic and poorly drained, water storage and slow rates of discharge may be an important watershed factor.

Stands are predominantly open grown and provide an abundant understory. Due to the generally open nature of this type, interior forest conditions associated with closed-canopy forests generally do not occur. Also, snow interception is reduced, snow pack can be more persistent, and temperature, wind, and humidity cyles are more extreme than in closed-canopy types. Production of arboreal lichens, berries and seeds is high. Mixed conifer stands are a significant component of the landscape patterns of southeast Alaska, often providing transition between muskeg and closed-canopy forests.

The mixed conifer plant association series of S.Oregon and N. California are ecologically and structurally different from Southeast Alaska mixed conifer forests and therefore are not comparable.

APPENDIX B (continued)

MOUNTAIN HEMLOCK OLD-GROWTH FOREST TYPE

Mountain hemlock trees can occur at all elevations from alpine tundra to saltwater in Southeast Alaska. The Mountain Hemlock Old-Growth forest type is a "cold" mostly high elevation type. It occurs from 2500 feet on south slopes on southern Prince of Wales Island to less than 1000 feet on northern islands near Glacier Bay. This type is present in all Southeast Alaska provinces, but occurs more in the northern than southern provinces.

General Description

Mountain hemlock is the dominant overstory tree. Sitka spruce is common in this group and may be a co-dominant on steep unstable slopes, subalpine fir may be co-dominant in localized areas, and Alaska-cedar or western hemlock may be co-dominant in southern Southeast Alaska transitional areas. Slope, aspect, topography, soil parent material, and weather patterns influence tree sizes and stand composition within this type.

The height of the upper canopy often ranges from 60 to 100 feet and large tree diameter may range from 21 to 35 inches. Large tree ages have been recorded as young as 41 years, however, most trees sampled(above 90%) were over 100 years. This type may have occasional large spruce or cedar well over 450 years of age.

Shrub cover (blueberry, copperbush, cassiope, & heather) often exceeds 50% and forb cover (deer cabbage, five leaf bramble, & bunchberry dogwood) often averages 30%. Sedges may dominate open, wet areas and Arboreal lichens, particularly *Alectoria* spp. are abundant on open grown trees.

Snags are highly variable, both in size and number, and are considered short lived due to the species, high snow loads, wind, and avalanching. Down material decomposes slowly due to cool, wet conditions.

Ecological Relationships

Wind, snow avalanching, and mass movement, are primary disturbance processes. Snow avalanching appears to be the dominant disturbance process in the open "parkland" like forests nearest treeline. Tree growth is much slower than on warmer well drained sites at low elevations. Cold temperatures are a primary ecological factor in this type. Regeneration is common in disturbed areas, but slow to respond due to heavy snow damage. While closed canopy forest conditions can occur (usually in bands less than 500 feet wide) stands are predominantly open grown, thus, stand size considerations relative to maintaining interior forest old-growth conditions are not significant in this type.

Adjacency to alpine and high interspersion of closed-canopy to open forest conditions within this forest type, contributes to overall ecosystem diversity.

APPENDIX B (continued)

SHOREPINE OLD-GROWTH FOREST TYPE

The Shorepine old-growth forest type occurs throughout Southeast Alaska from sea level to the subalpine zones. It can be found on broken mountain slopes, hill slopes or wherever very poor soil drainage occurs. The type is often found on lowlands and is typically in association with open muskegs. The shorepine old-growth forest type is differentiated from "tree covered muskeg" in that it contains at least 10% tree cover. Areas that contain less than 10% tree cover are considered non forest.

General Description

Shorepine is the dominant overstory tree. Alaska-cedar is often present but sparsely represented with mountain hemlock, western hemlock, Sitka spruce, and western red cedar occurring in some stands. Conifer tree cover is sparse compared to other old-growth types. Tree canopy cover ranges from 10 to 50%. Trees are typically short, poorly formed and widely spaced. The height of the upper canopy often ranges from 20-60 feet and diameters of large trees are often 9 to 15 inches. Large trees have been recorded as young as 100 years, however most large trees sampled (86% of those over 9") exceeded 130 years of age. Cedar can exceed 1000 years old on these sites.

Shrub cover (commonly crowberry, dwarf blueberry, and mountain cranberry) as well as a number of inconspicuous shrubs are an important component of these stands. Forb cover (bunchberry and skunk cabbage) is often 40-60% and sedges (typically 60-75% cover) are a major ground cover component.

Snags are variable, both in size and number, are generally shorepine, and are considered long lived due to their short stature. Down material is sparse, small and is often covered with creeping ground vegetation. Due to the short tree stature, most down material originates from previously dead snags that have fallen over from decomposition. Therefore, most down material is in an advanced state of decay.

Ecological Relationships

Trees are very slow growing on this type and though relatively small size are often quite old. This forest type is open grown and interior forest conditions do not occur. The type provides "edge" habitat as a transition zone from muskeg to the mixed conifer forest type.

Because soils are deep, organic, and poorly drained, water storage and rates of discharge may be an important watershed consideration.

Shorepine sites play an important role in watershed regulation by absorbing excessive rainfall and regulating flows. The shorepine forest type (along with its muskeg associate) are a substantial component of the diverse landscape patterns in Southeast Alaska.

APPENDIX C

DATA TABLE AND CODES

The ORACLE data table developed from the 1980's Timber Inventory data is named Diaview. It resides in the Region 10 Developmental Data Base.

A description of fields and their codes used in this analysis is as follows:

FIELD	CODES(EXAMPLES)	EXPLANATION
PLOT	(296, 510, 308207)	--Plot numbers, Stikine begins with 2, Chatham with 3, and Ketchikan with 5.
FOREST_TY	(SS-AL, WH/WRC-WD)	--Old-growth forest types, each plot was labeled as a distinct type.
D_MEAS	(12.7, 41.2)	--Measured diameter of a tree on a plot.
DIA	(3,15)	--2" diameter grouping the tree is in.
H_MEAS	(96,158)	--Measured height of a tree on a plot.
HEIGHT	(40,180)	--10' height grouping the tree is in.
AVEHT	(126)	--Average height of the dominant canopy of that particular type. Used to determine canopy layers.
AGE	(92, 308)	--Measured age of a given tree.
HIST	1-live tree 5-live site tree(on plot) 4-mortality tree(dead) 7-older dead tree	--Used to differentiate live & dead trees.
C_CLASS	1-Isolated tree 3-Codominant tree 4-Intermediate tree 5-Suppressed tree	--Crown class, used to differentiate the 2-Dominant tree main canopy.
TREE_ACRE	(2.6,8.1)	--The number of trees per acre that sample tree represents. Used to summarize tree per acre values.
DAMAGE	(23, 67)	--Codes used to analyze decadence.

23-Conks on bole
28-Cankers on bole
29-Root rot damage
50-General weather damage
52-Windthrow damage
53-Snow damage
55-Avalanche, slide, flood, etc.
54-Frost crack
56-Windshake
59-Other weather damage
61-Natural/mech damage
62-Top broken out
64-Dying or spiked top
63-Forked top
65-Deformed top
66-Deformed bole
67-Excessive lean
68-Sound cull

APPENDIX D

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: SITKA SPRUCE-ALLUVIAL

TABLE 3-Diameter Distribution

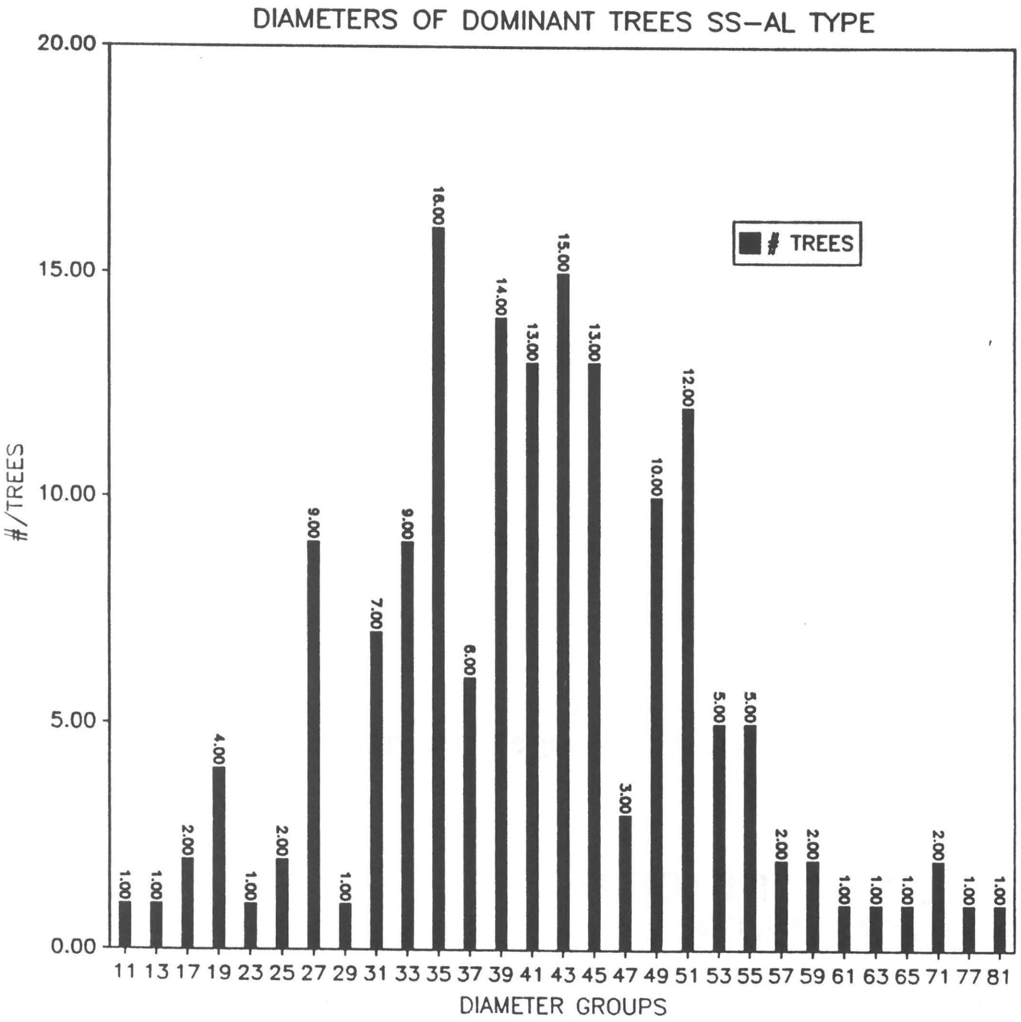
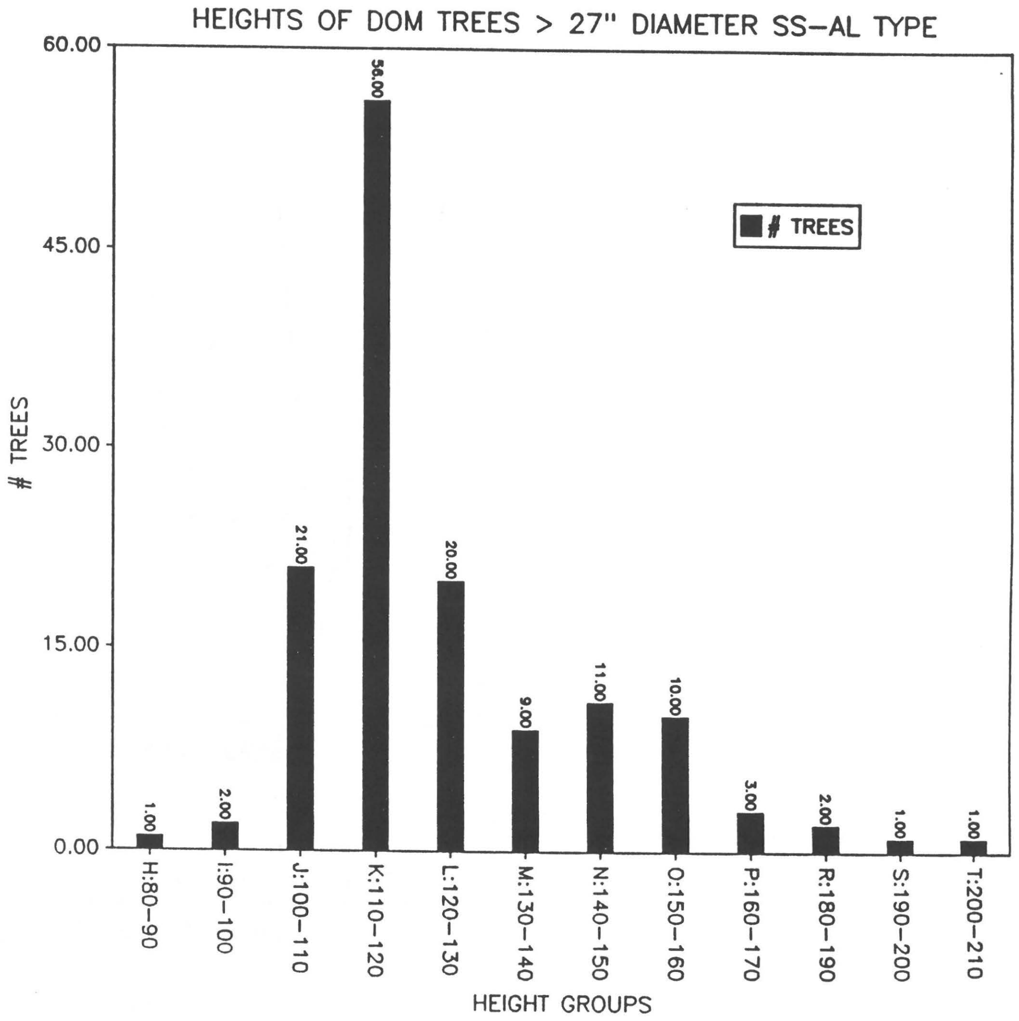


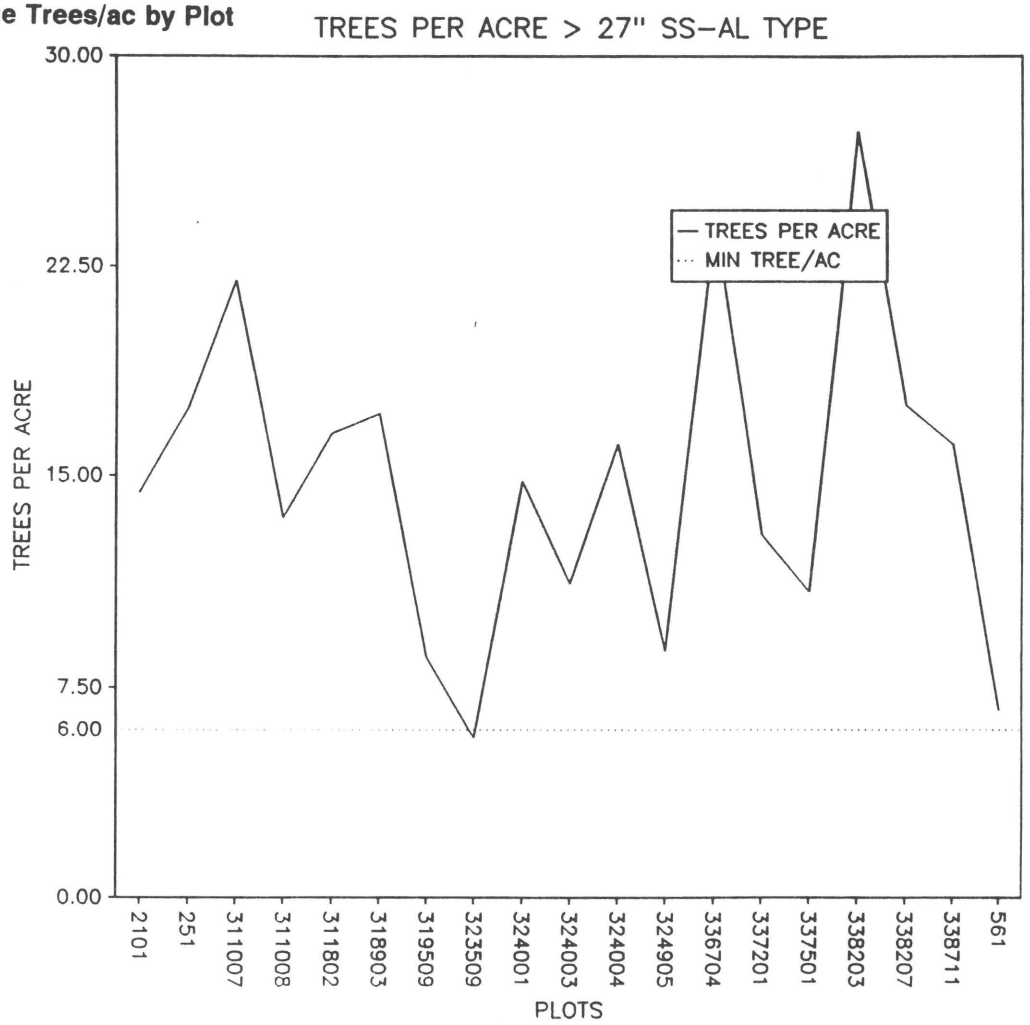
TABLE 4-Height Distribution



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: SITKA SPRUCE-ALLUVIAL

TABLE 5-Large Trees/ac by Plot



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: SITKA SPRUCE-OTHER

TABLE 3-Diameter Distribution

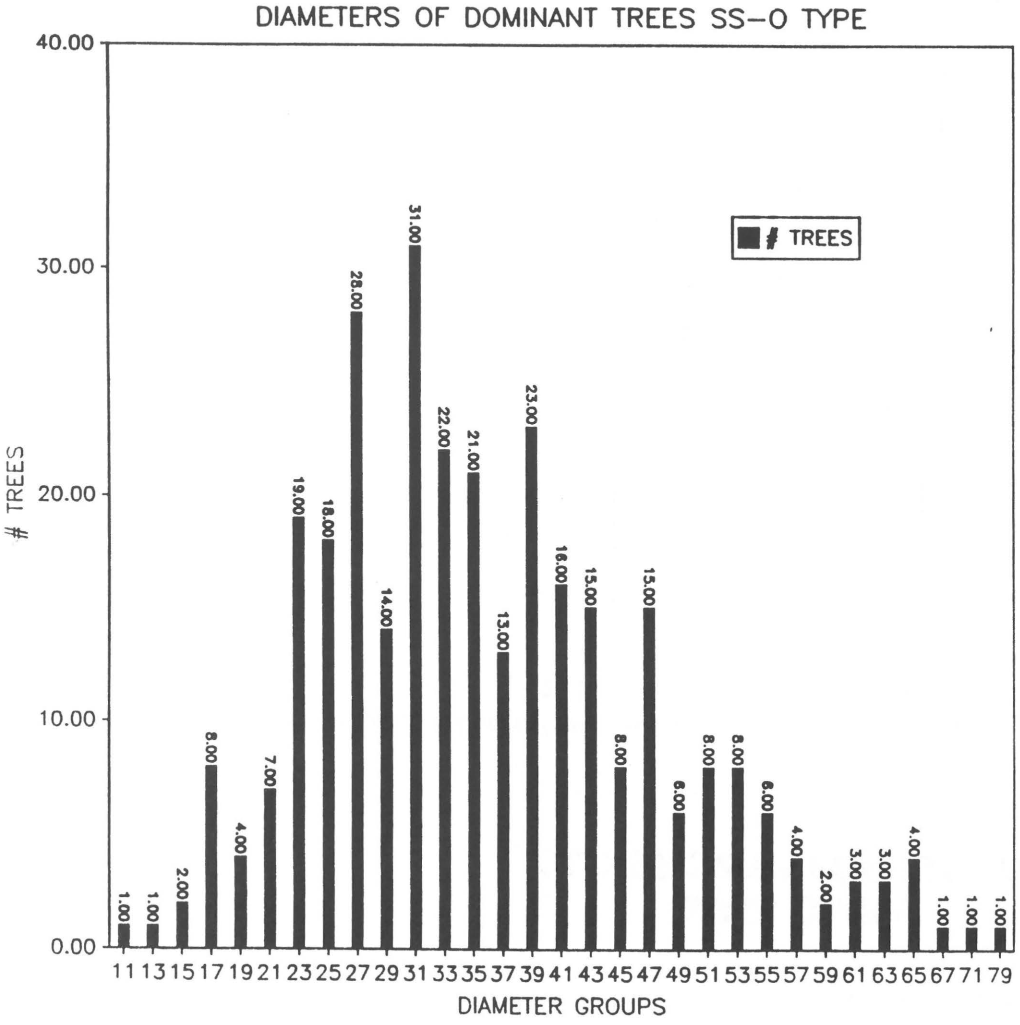
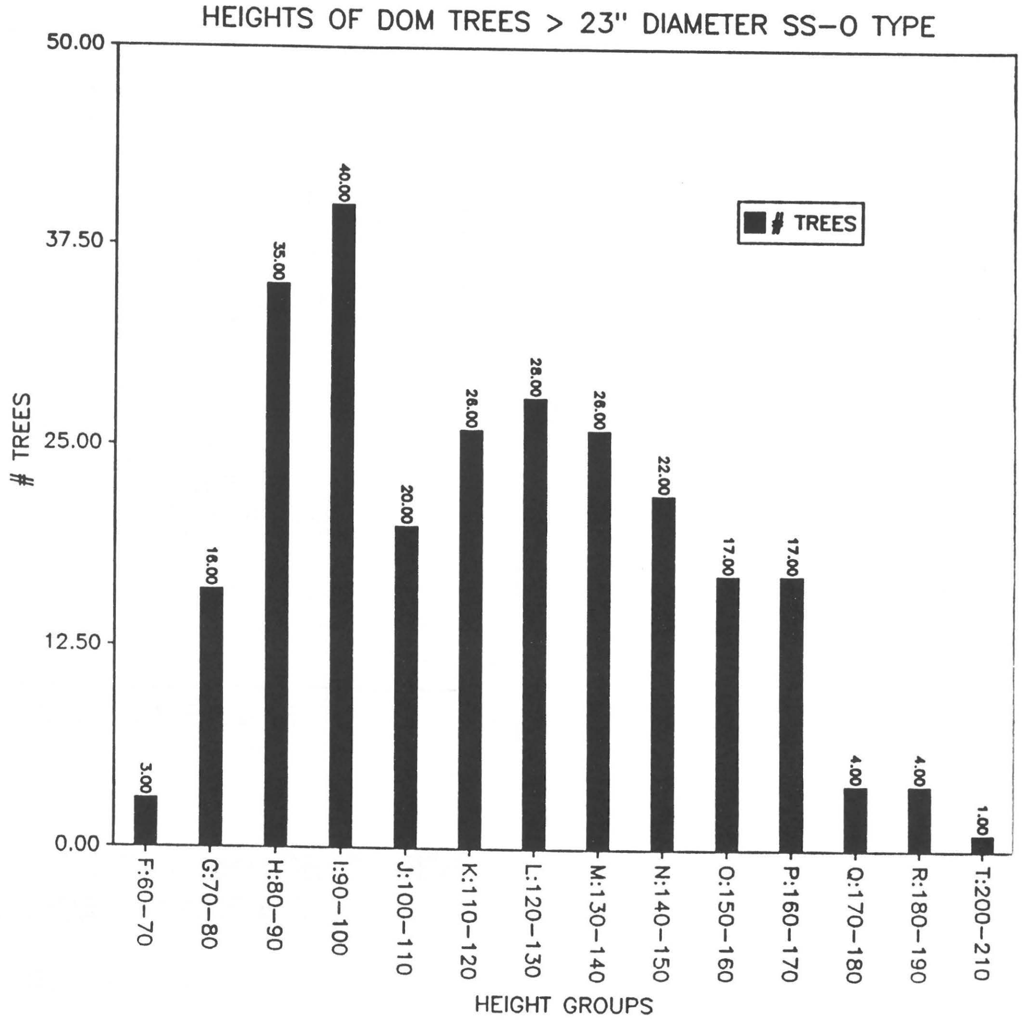


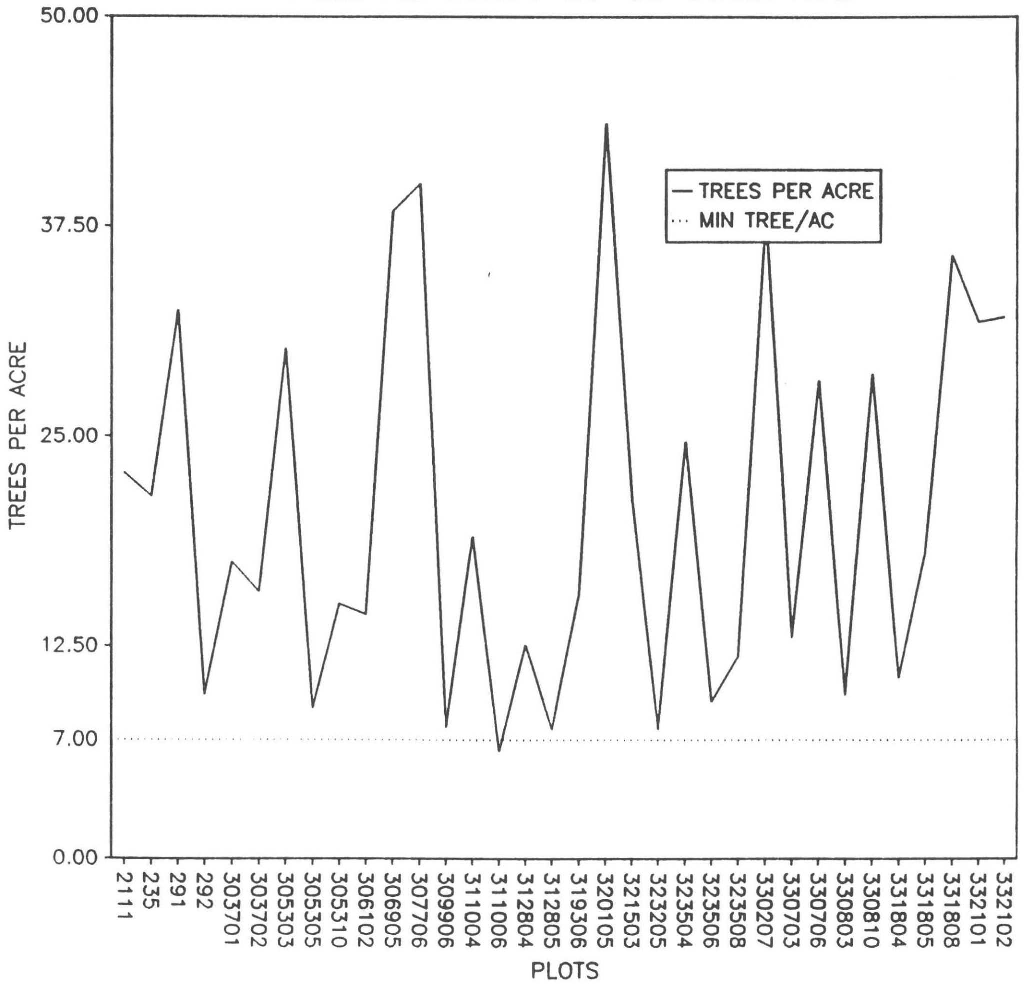
TABLE 4-Height Distribution



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: SITKA SPRUCE-OTHER

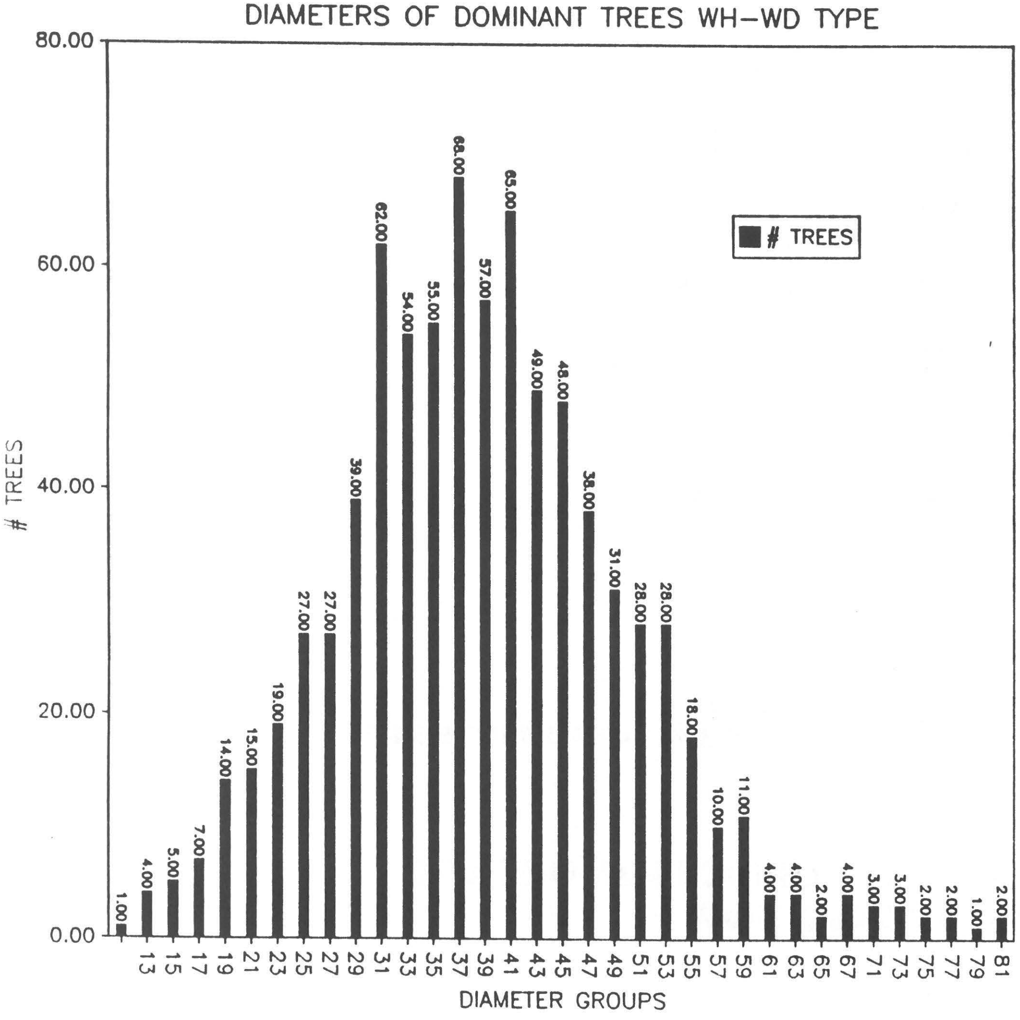
TABLE 5-Large Trees/ac by Plot



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: WESTERN HEMLOCK WELL-DRAINED

TABLE 3-Diameter Distribution



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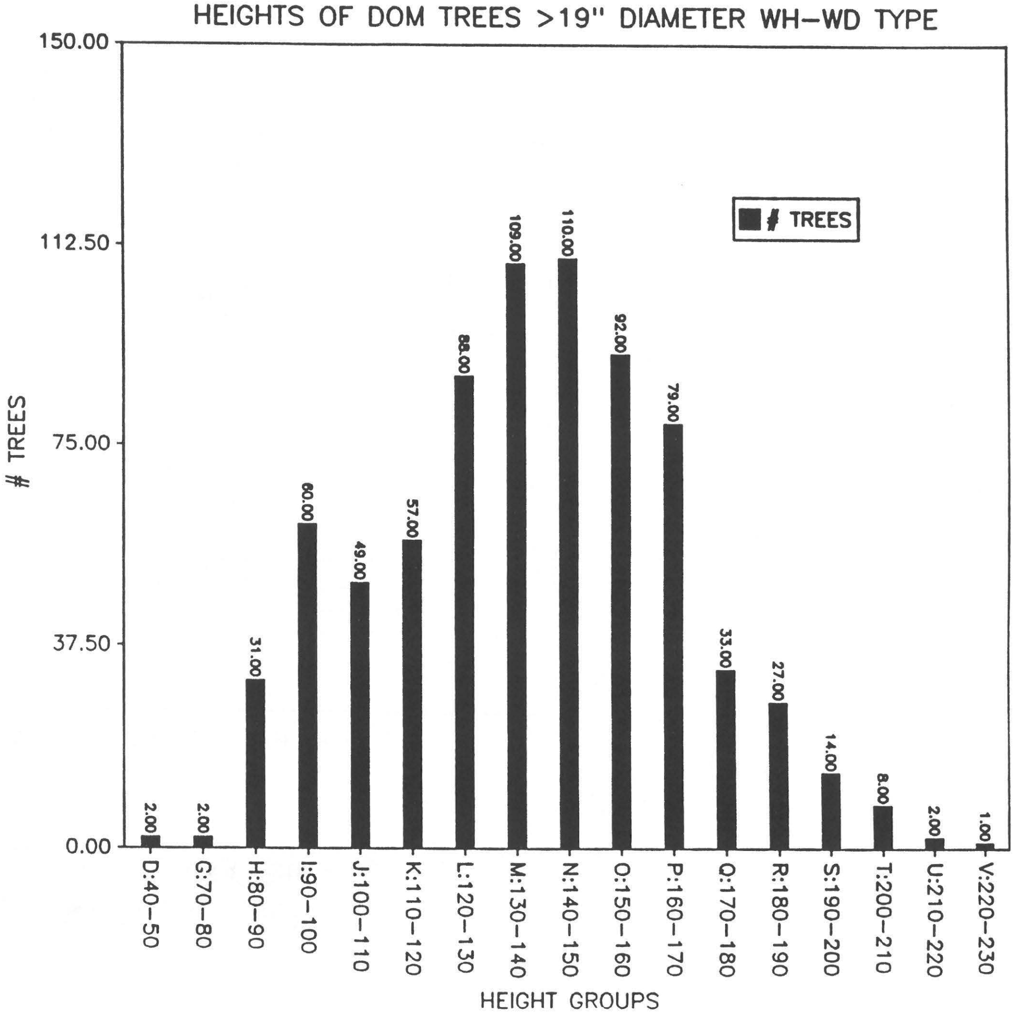
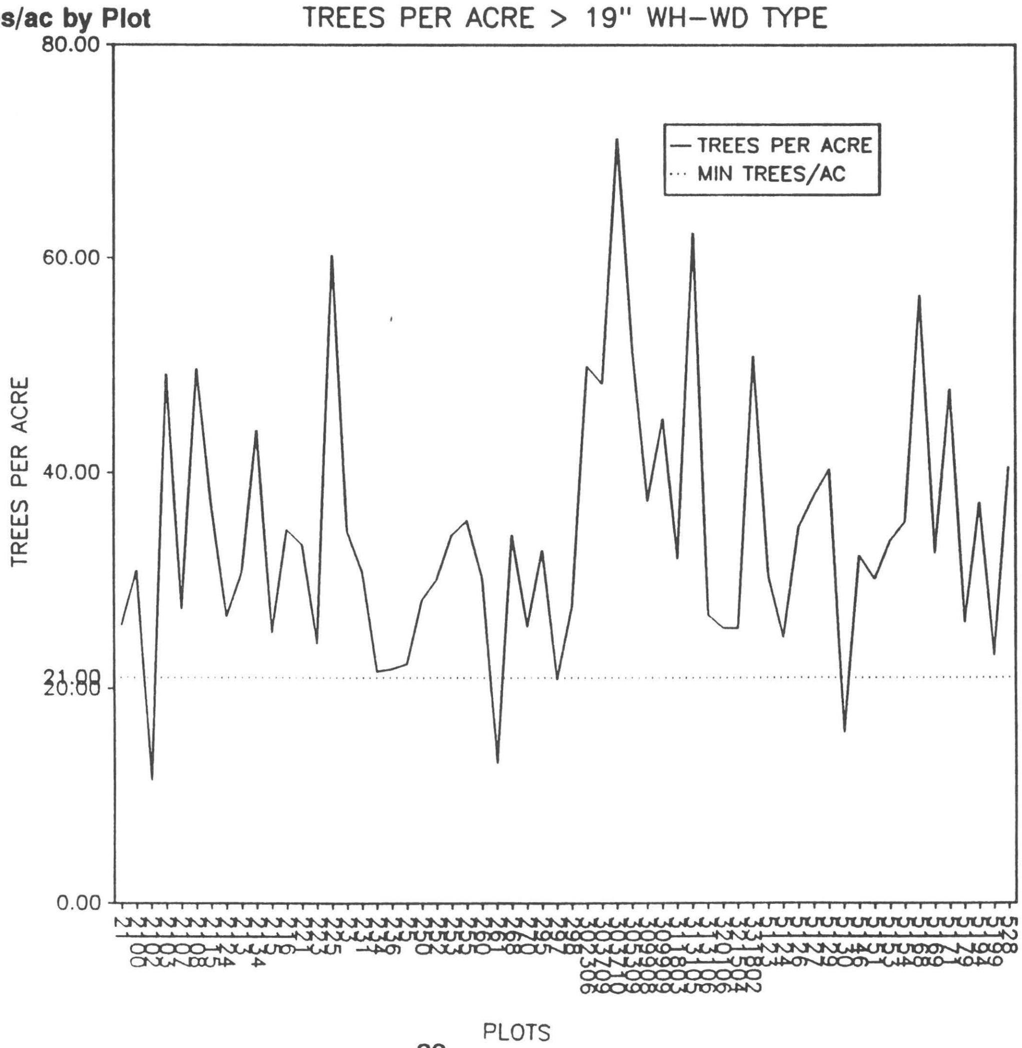


APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: WESTERN HEMLOCK WELL-DRAINED

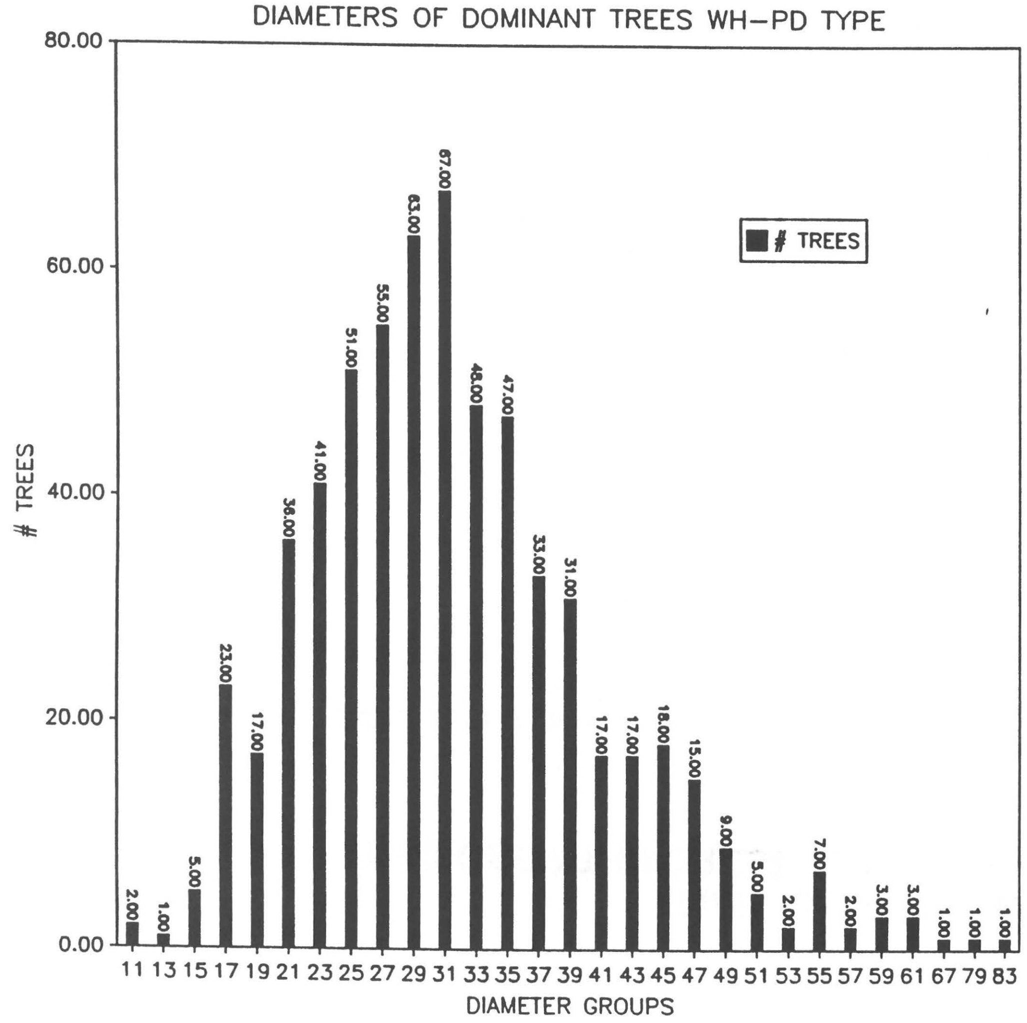
TABLE 5-Large Trees/ac by Plot



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: WESTERN HEMLOCK POORLY-DRAINED

TABLE 3-Diameter Distribution



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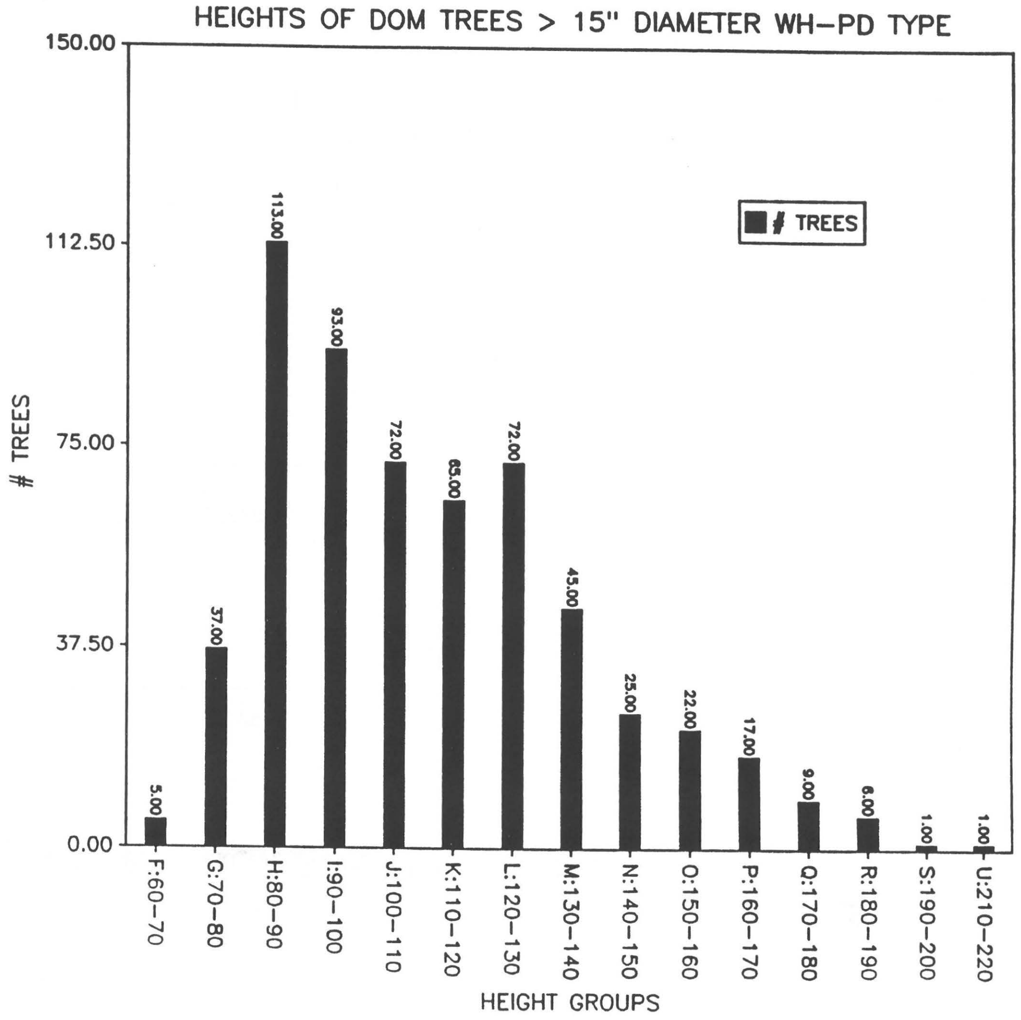
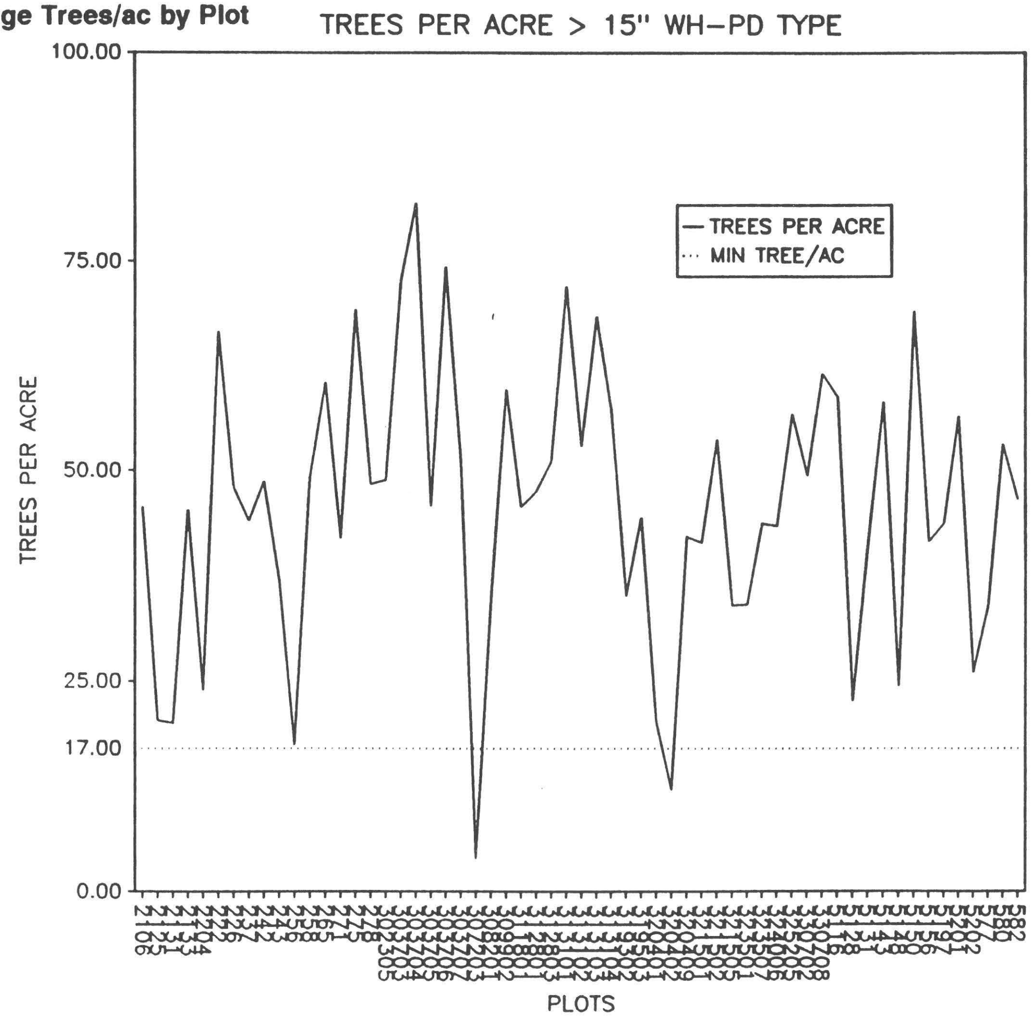


APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: WESTERN HEMLOCK POORLY-DRAINED

TABLE 5-Large Trees/ac by Plot



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: WESTERN HEMLOCK/WESTERN REDCEDAR WELL-DRAINED

TABLE 3-Diameter Distribution

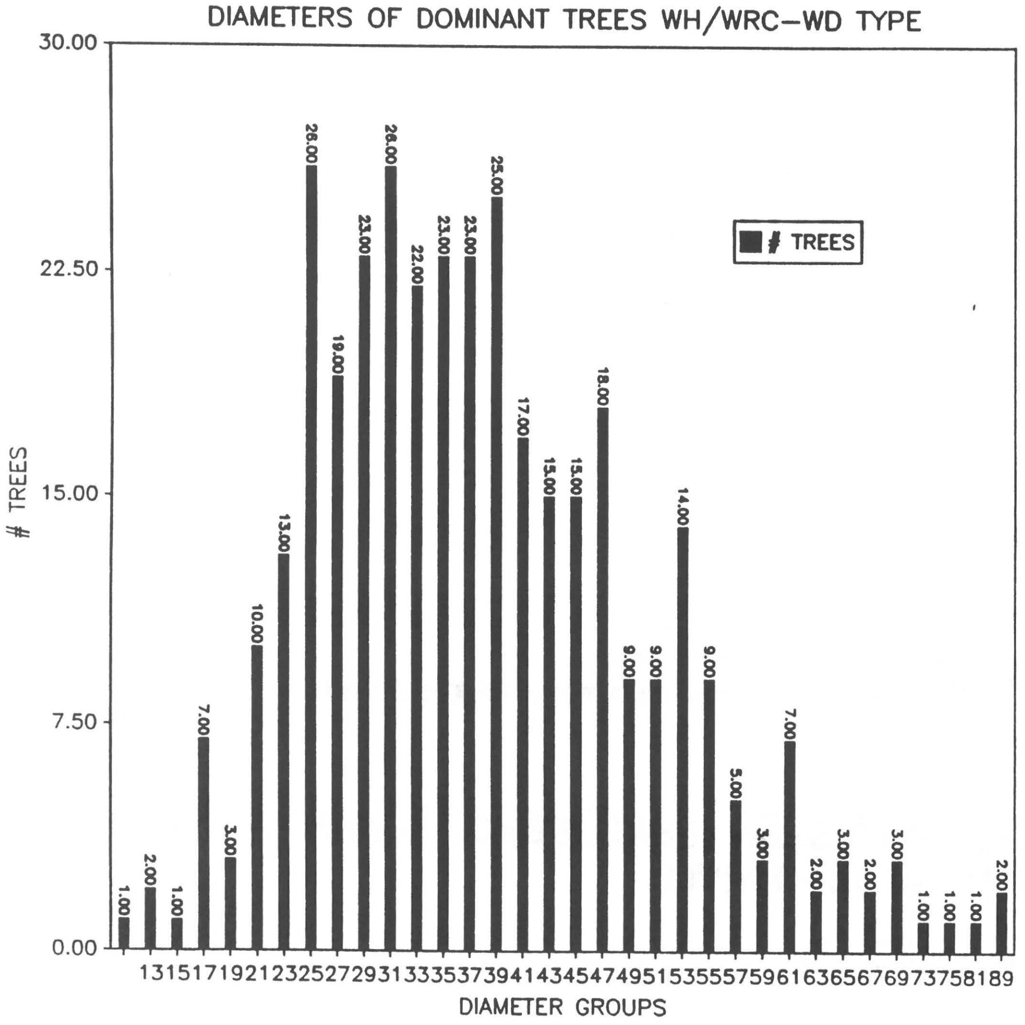
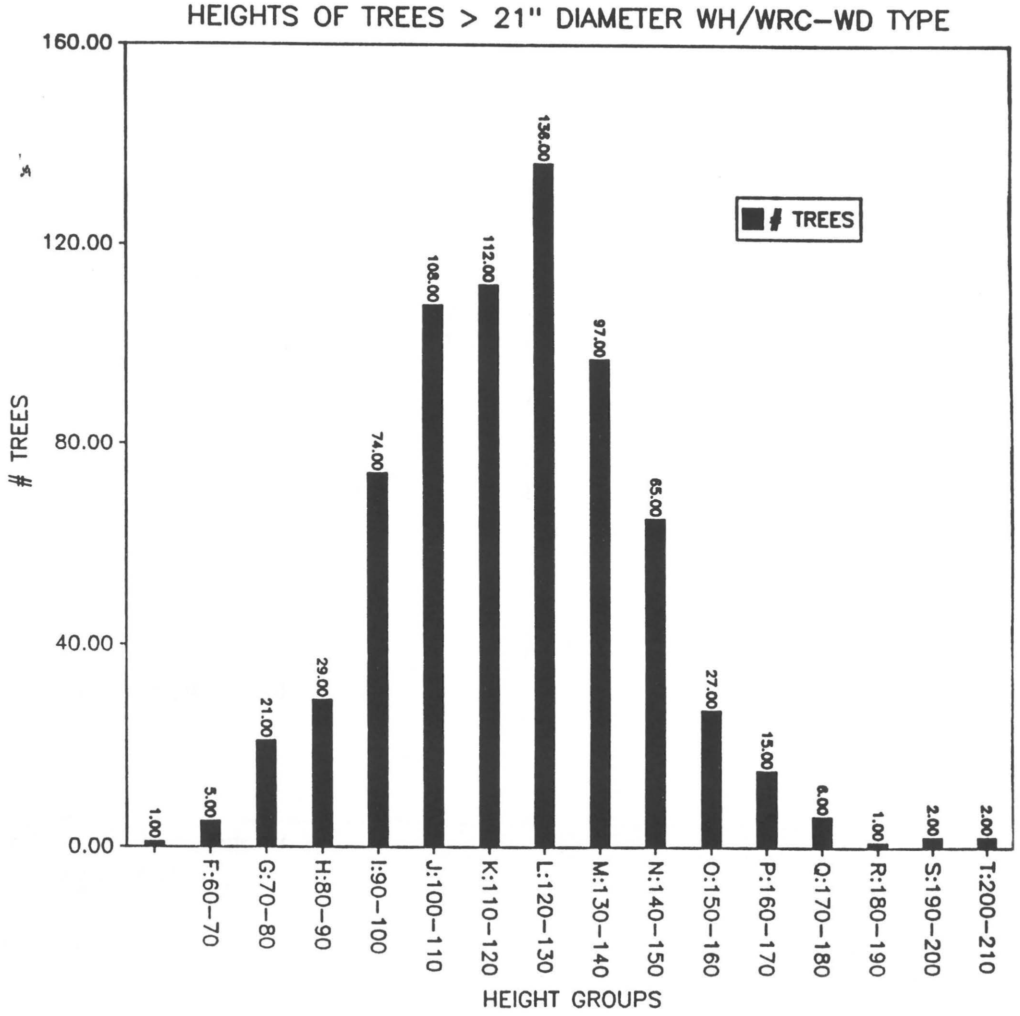


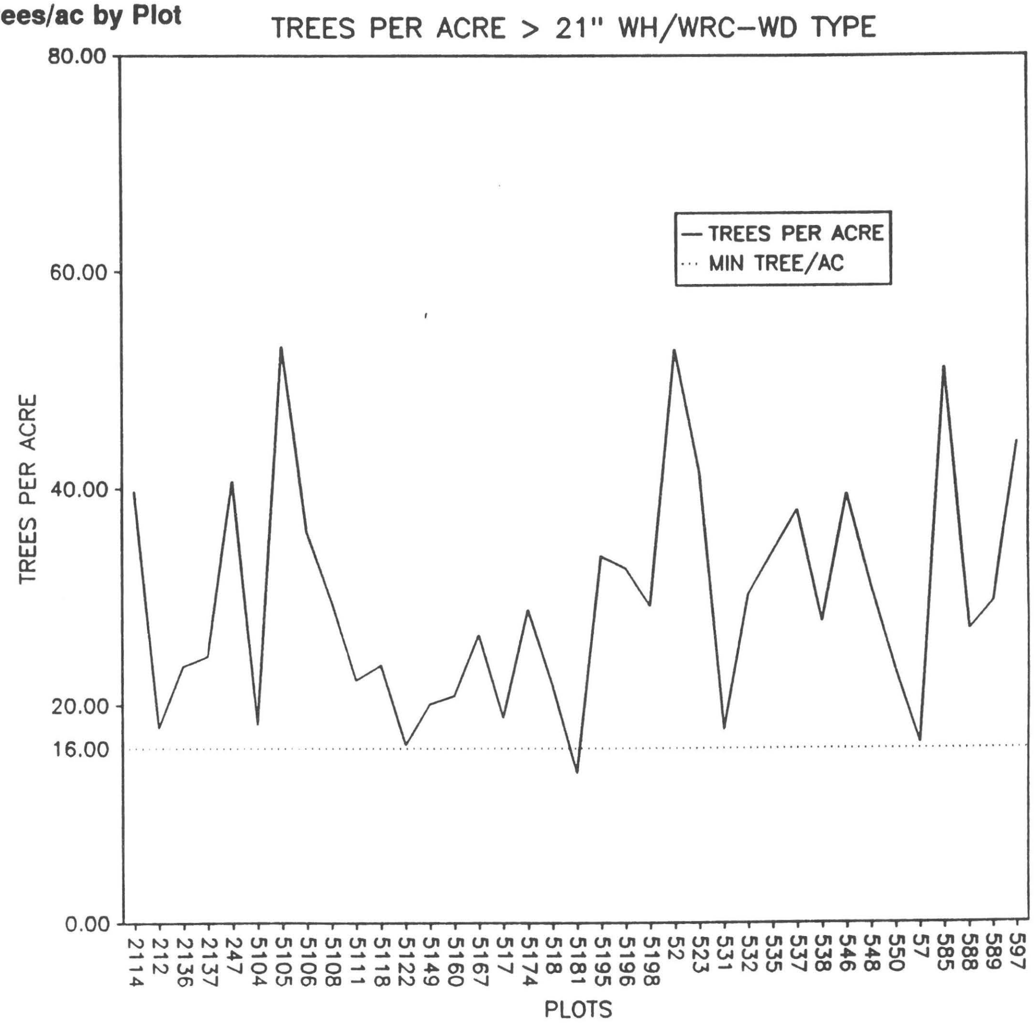
TABLE 4-Height Distribution



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: WESTERN HEMLOCK/WESTERN REDCEDAR WELL-DRAINED

TABLE 5-Large Trees/ac by Plot



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: WESTERN HEMLOCK/WESTERN REDCEDAR POORLY-DRAINED

TABLE 3-Diameter Distribution

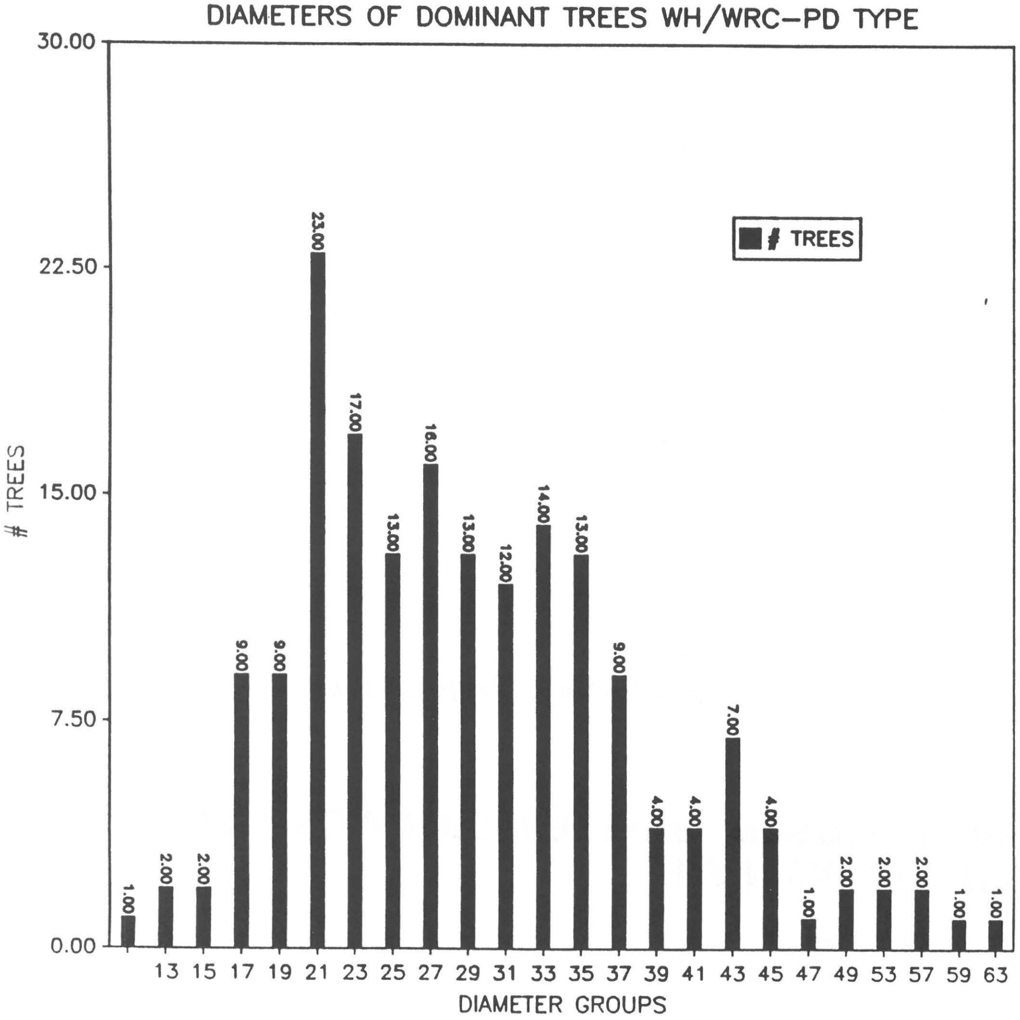
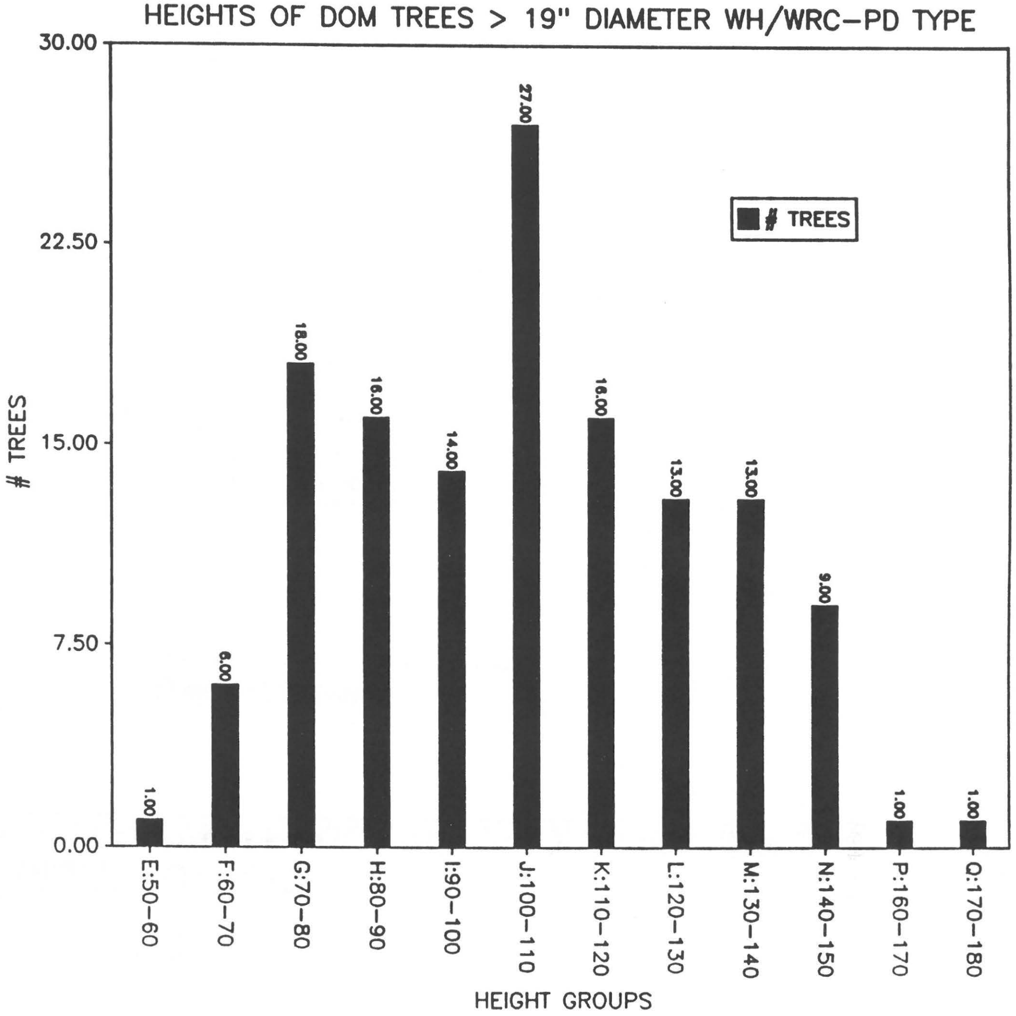


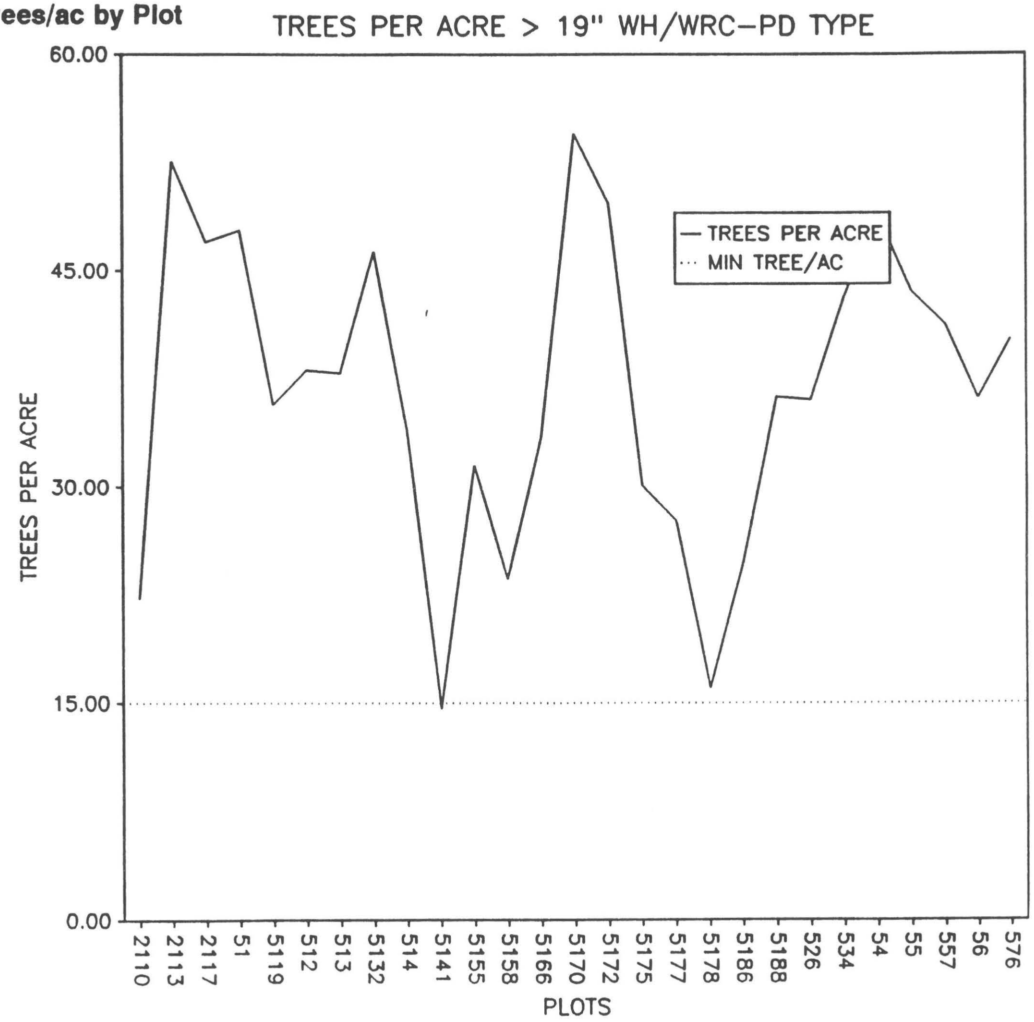
TABLE 4-Height Distribution



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: WESTERN HEMLOCK/WESTERN REDCEDAR POORLY-DRAINED

TABLE 5-Large Trees/ac by Plot



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: WESTERN HEMLOCK/ALASKA-CEDAR

TABLE 3-Diameter Distribution

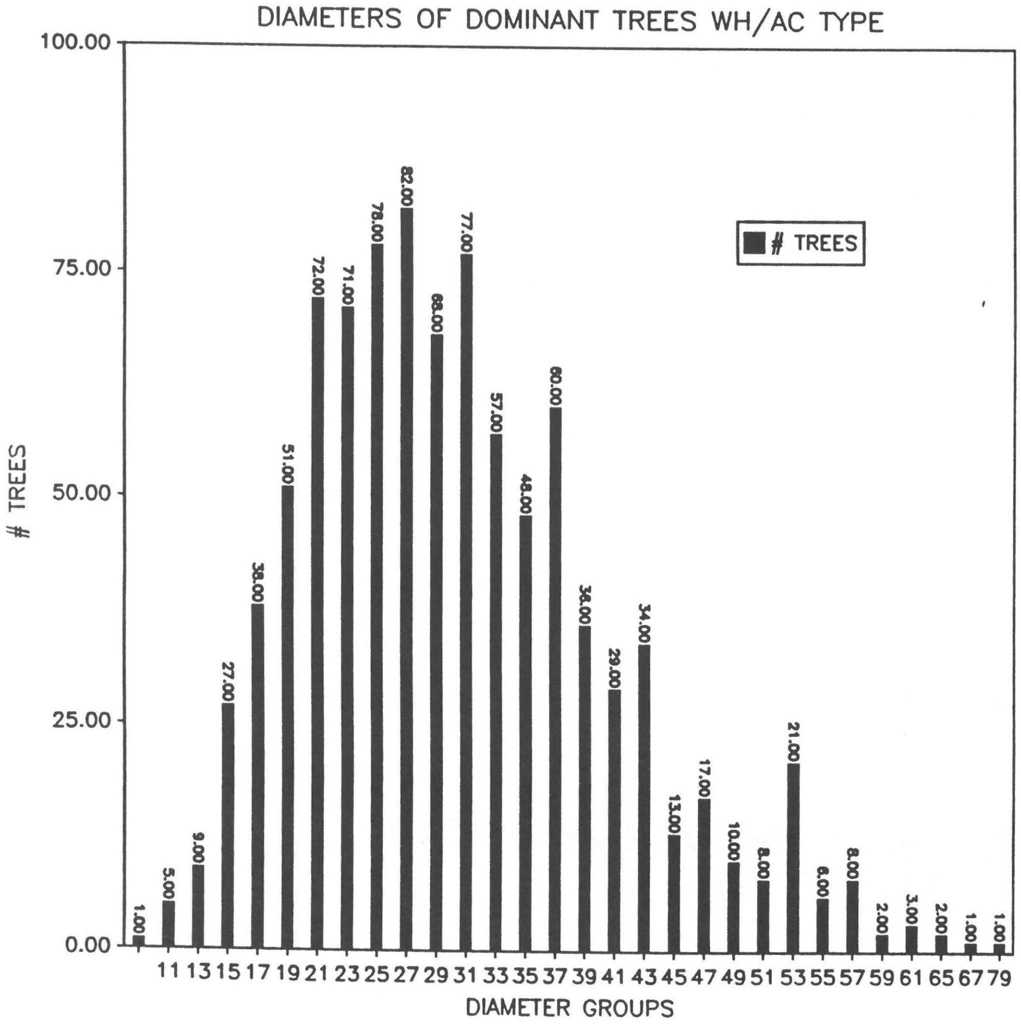
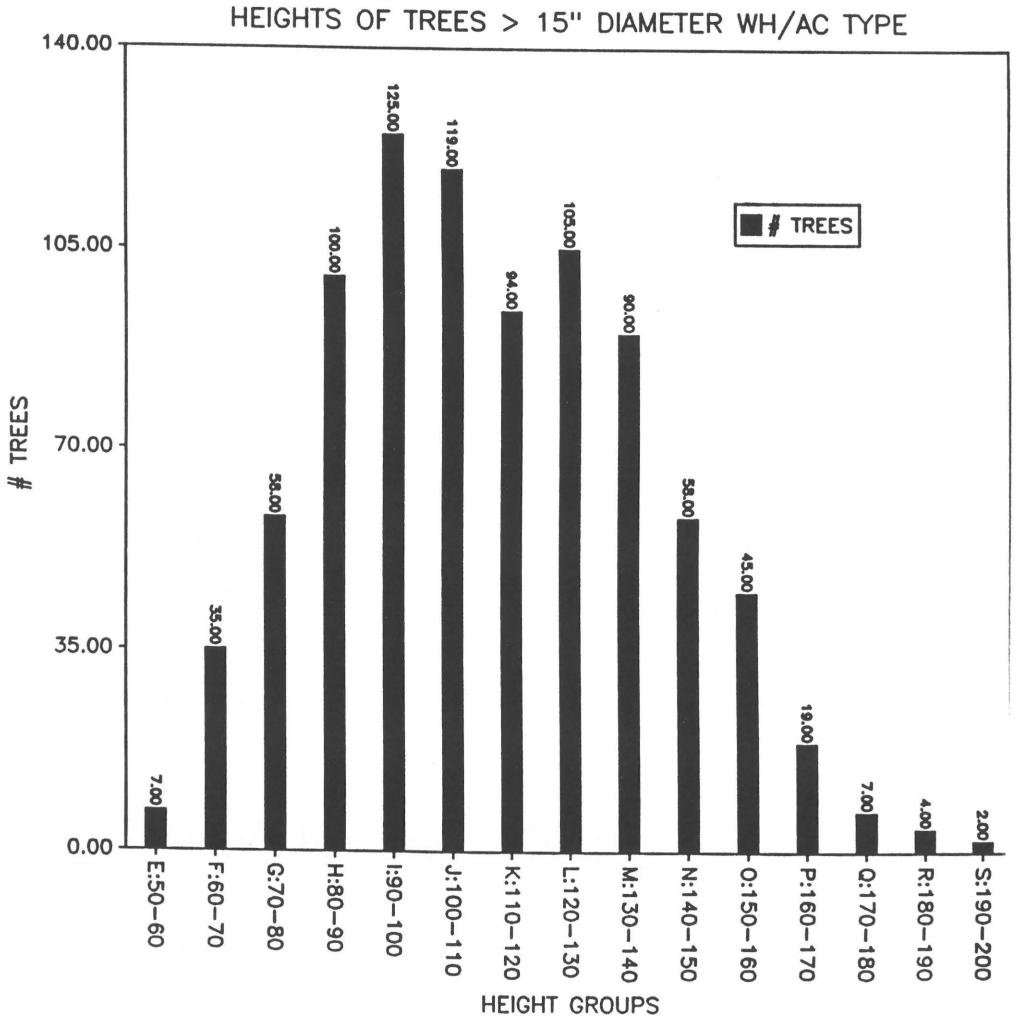


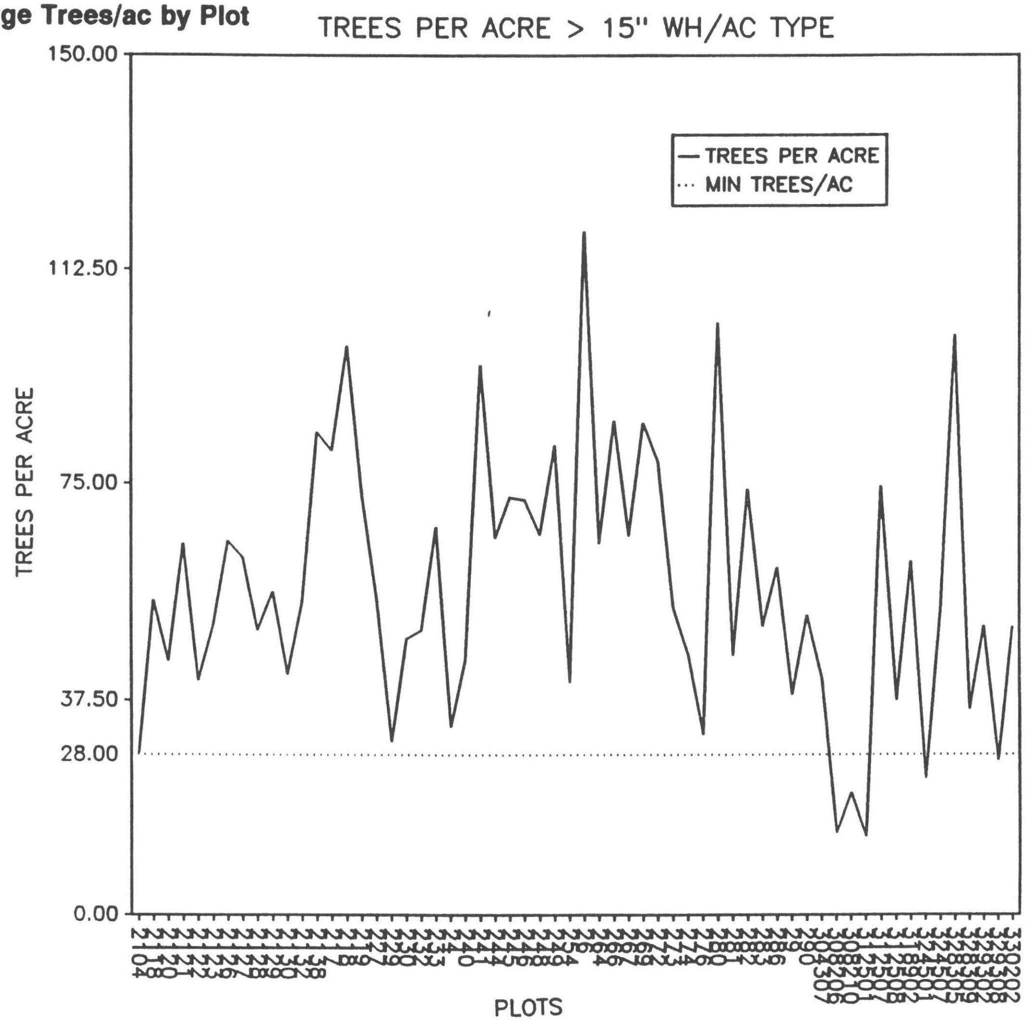
TABLE 4-Height Distribution



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: WESTERN HEMLOCK/ALASKA CEDAR

TABLE 5-Large Trees/ac by Plot



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: MIXED CONIFER

TABLE 3-Diameter Distribution

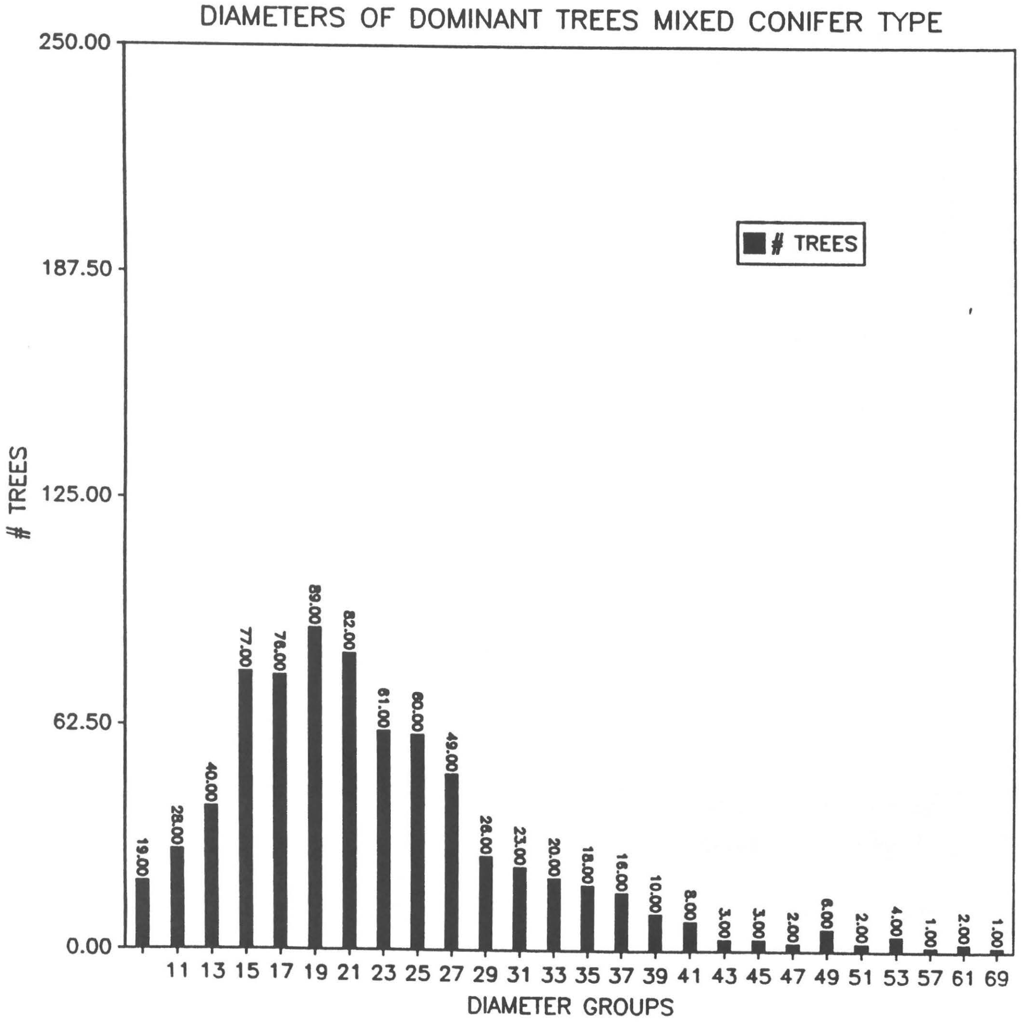
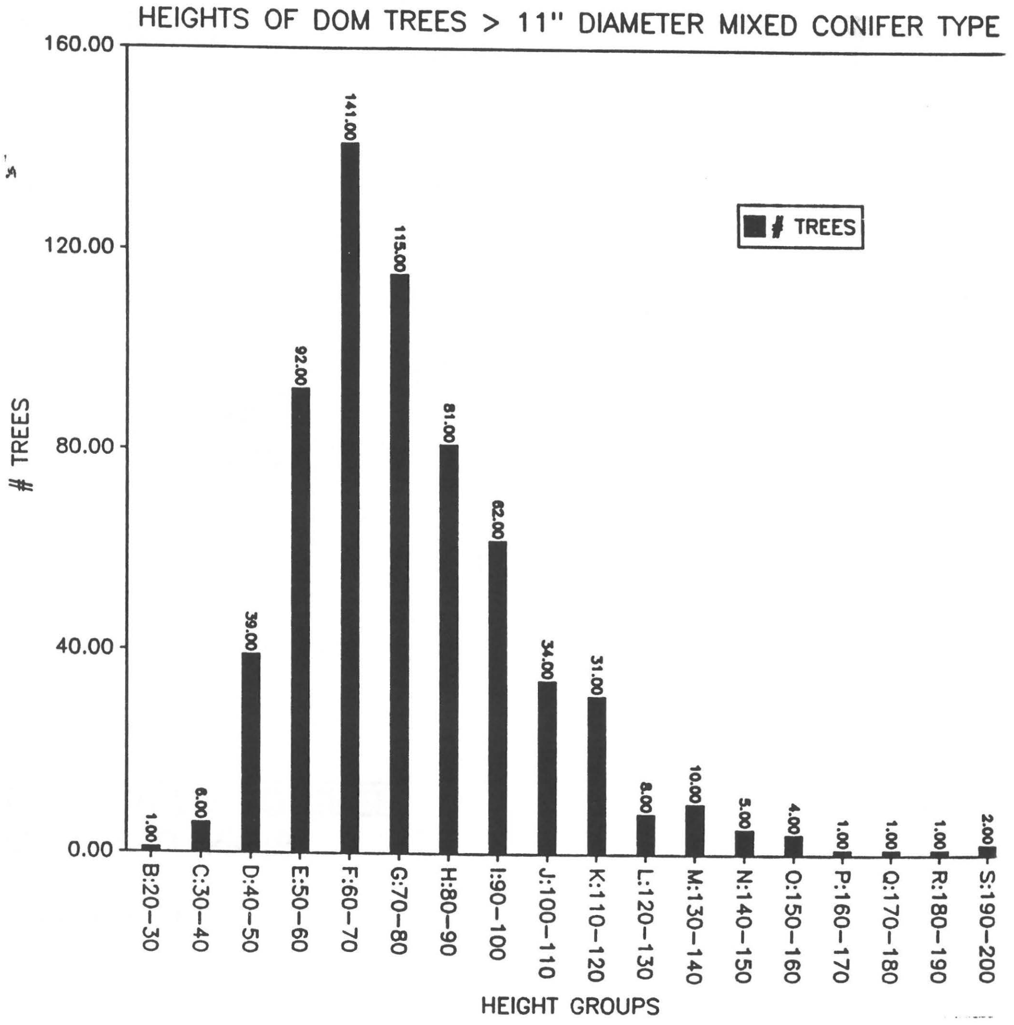


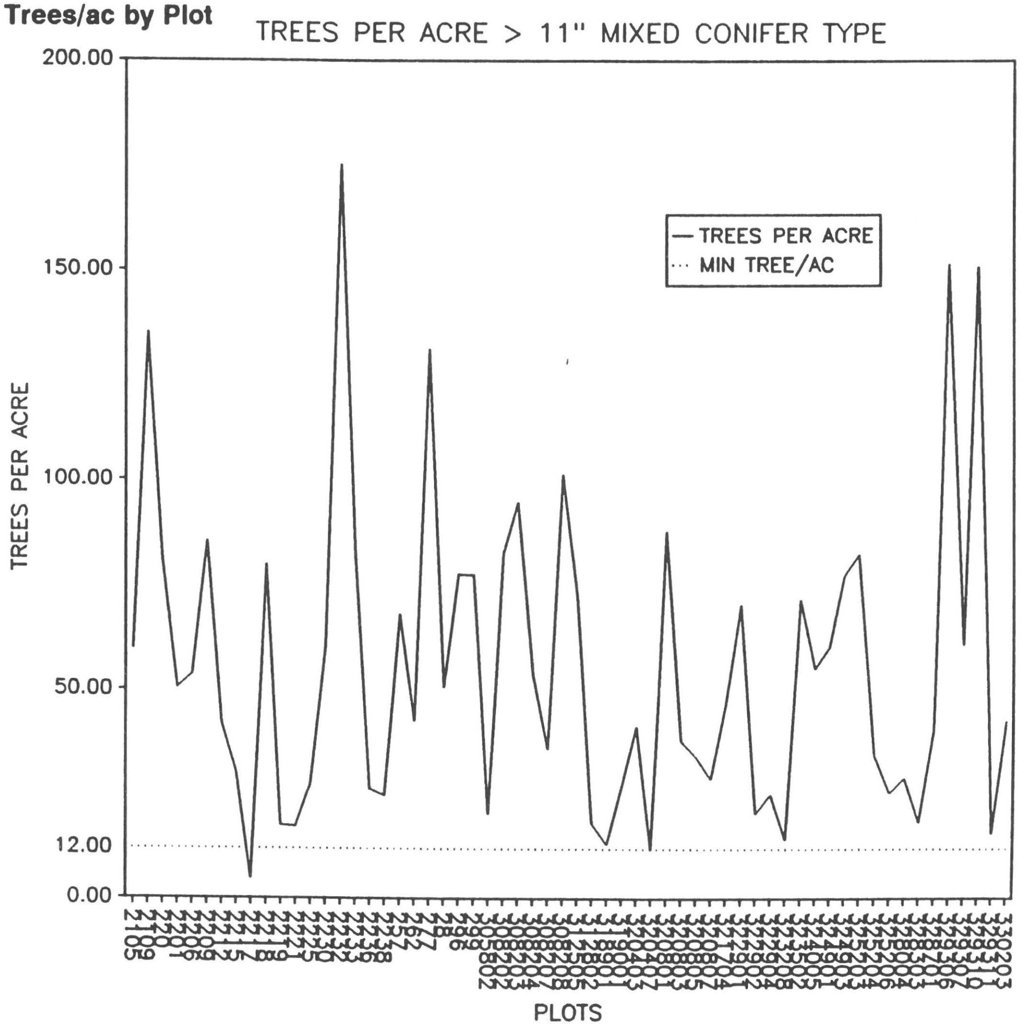
TABLE 4-Height Distribution



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: MIXED CONIFER

TABLE 5-Large Trees/ac by Plot



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: MOUNTAIN HEMLOCK

TABLE 3-Diameter Distribution

DIAMETERS OF DOMINANT TREES MTN HEM TYPE

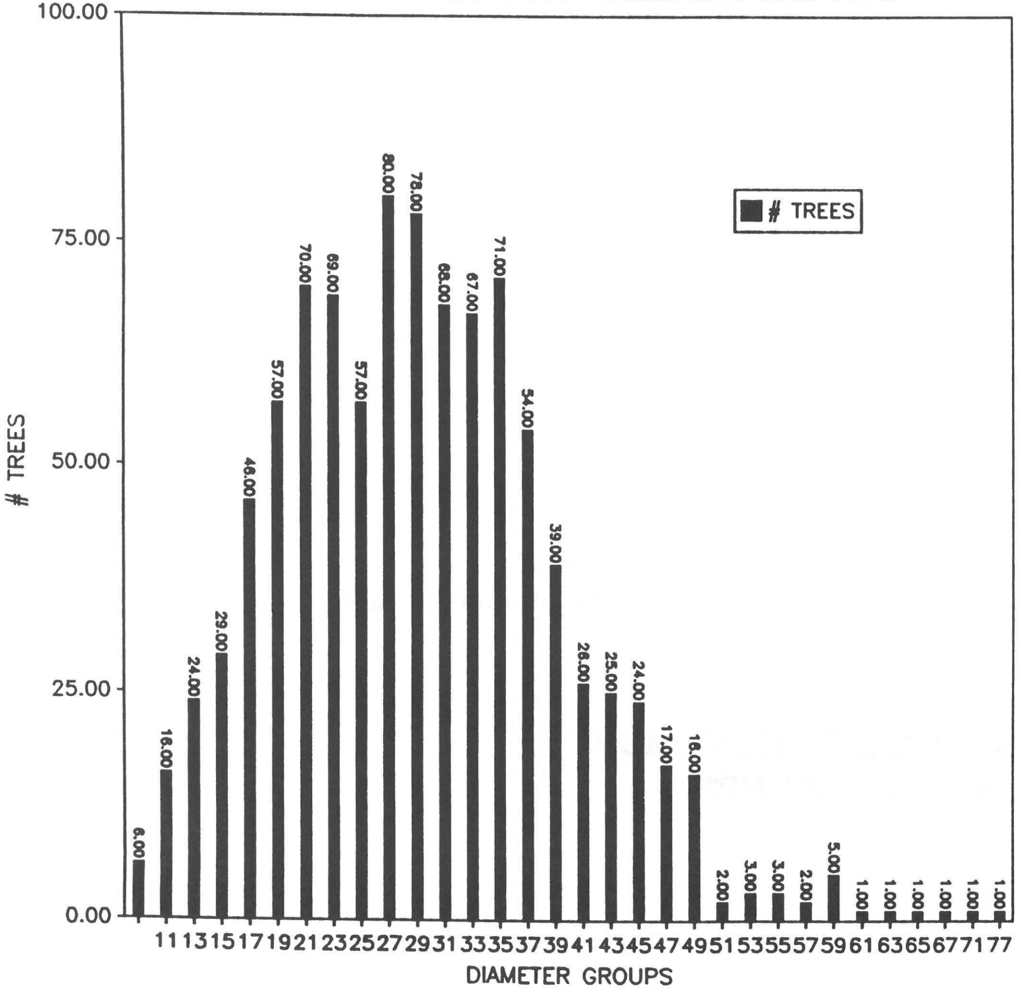
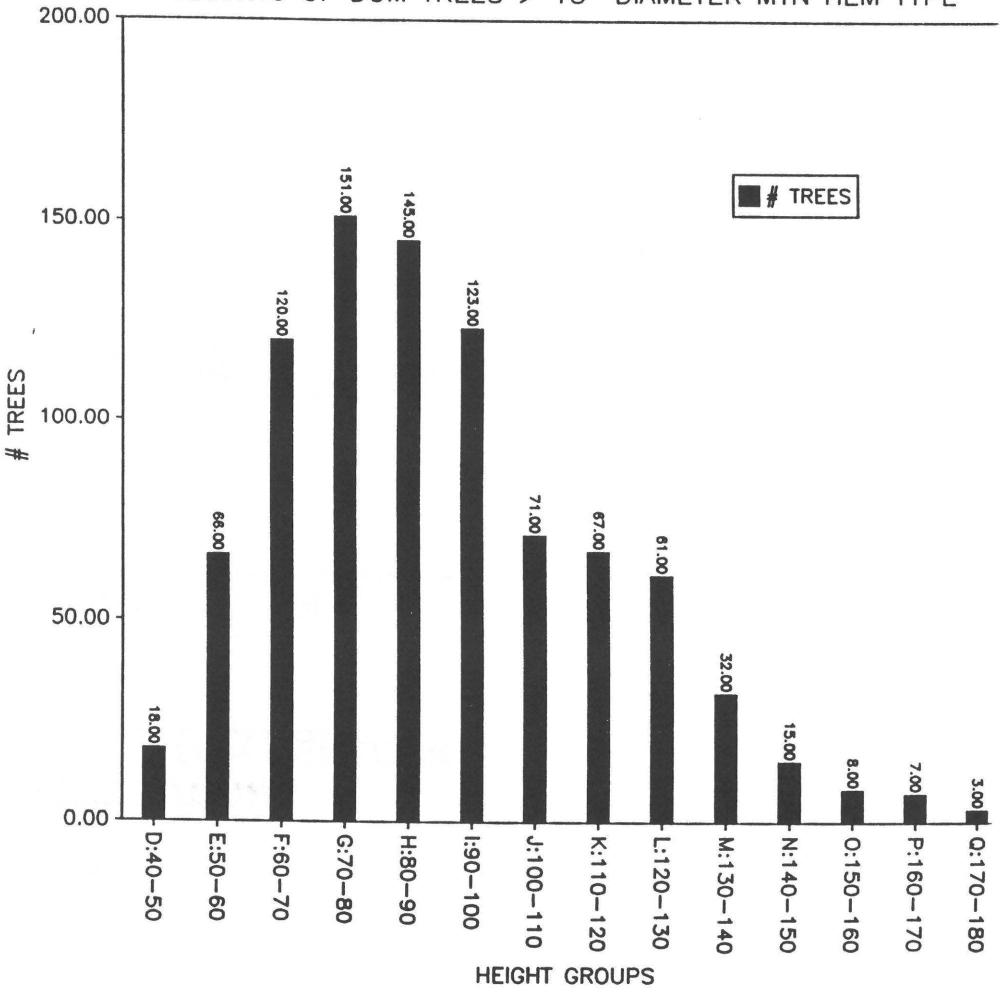


TABLE 4-Height Distribution

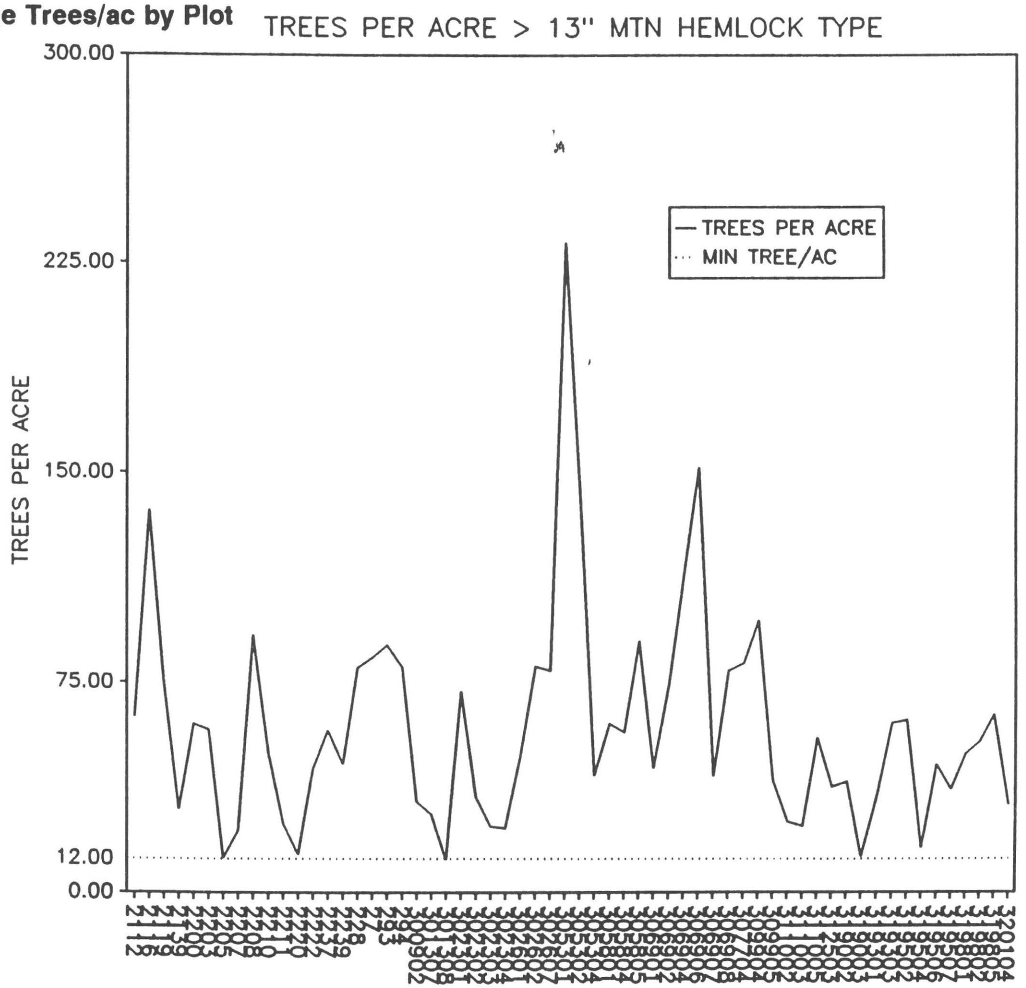
HEIGHTS OF DOM TREES > 13" DIAMETER MTN HEM TYPE



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: MOUNTAIN HEMLOCK

TABLE 5-Large Trees/ac by Plot



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: SHOREPINE

TABLE 3-Diameter Distribution

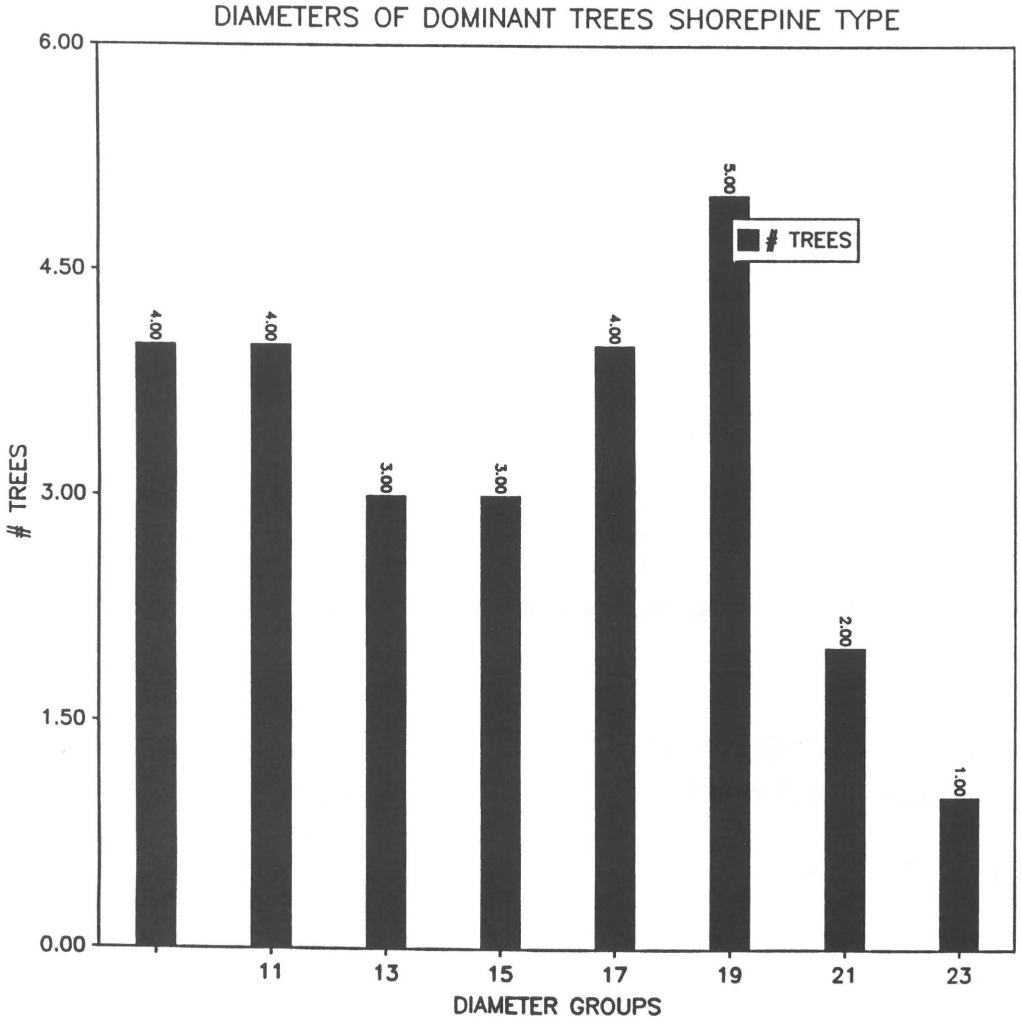
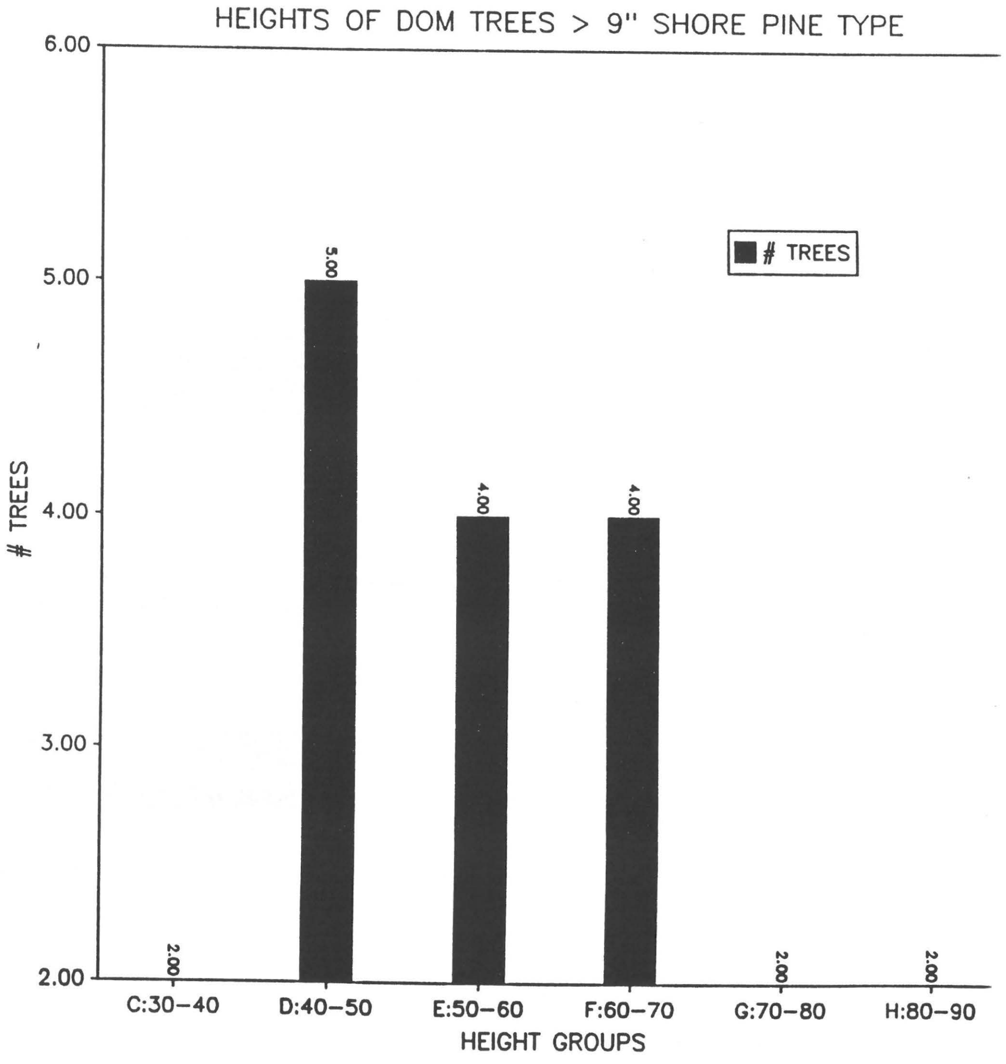


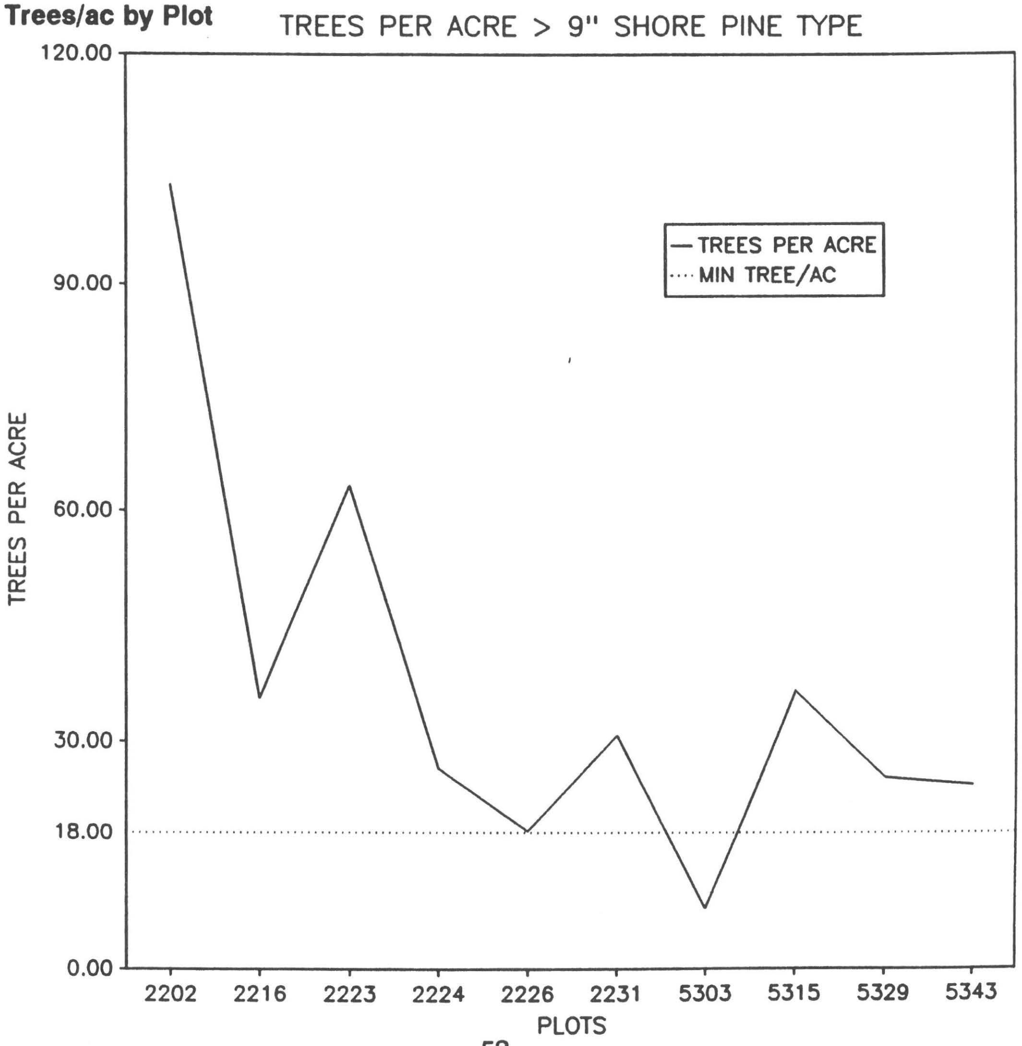
TABLE 4-Height Distribution



APPENDIX D (continued)

MAIN CANOPY TREE DISTRIBUTIONS
OLD-GROWTH FOREST TYPE: SHOREPINE

TABLE 5-Large Trees/ac by Plot



APPENDIX E

OLD-GROWTH DATA COLLECTION CARD

LOCATION: ____________________ CNUM ______
UNIT #: ____________________
STAND #: ____________________

Tongass National Forest
Data Card

Plot Radius = 42 feet
4 ft. radius = 1%, 9 ft. radius = 5%, 13 ft. radius = 10%

DATE: __________ PLOT #: __________ AIR PHOTO #: ____________________
OBSERVERS: __________________ VCU (WATERSHED #): ____________________
ELEV: ________ elevation above sea level
ASP: ________ degrees
SLPE: ________ % slope
SDRC: ________ soil drainage class: 1-vp,2-p,3-sp,4-mw,5-w
EBRK: ________ % surface bedrock exposed
PA #: ________ plant association code number
RAPT: ________ raptors: 0-no,1-observed,2-nest,3-roost,identify ______________
DROW: ________ deer browsing: 0-none,1-light-mod.,2-heavy
DEER: ________ deer trails: 0-none,1-light,2-heavy
PELL: ________ pellet groups: 0-no, 1-1,2-2-5,3>5

THGT: ________ mean height of dominants, ft.
DBA: ________ dead basal area of snags > 10 ft.
WHBA: ________ TSHE (WH) basal area
SSBA: ________ PISI (SS) basal area
YCBA: ________ CHNO (YC) basal area
MHBA: ________ TSME (MH) basal area
LPBA: ________ PICO (LP) basal area
BAF: ________ BASAL AREA FACTOR (20, 40 or 62.5 BAF)
OVCO: ________ % overstory canopy cover
CL #: ________ number of tree canopy layers
TSHB ________ % tall shrub cover
VASP ________ % vaccinium species cover
VAHT ________ mean height of vaccimum species(record 6 inch increments)
FORB ________ % forb cover
FERN ________ % fern cover
SDP: ________ soil depth to impermeable layer, in.
OMDP: ________ organic matter depth, total in. (to 120 cm)

PM: ________ parent material: 1=colluv,2=alluv,3=resid,4=ash,5=till,6=om
MICR: ________ slope shape in plot (cx=1,st=2,cv=3,und=4,pit and mound=5)
RILL: ________ rill frequency
GRD: ________ % bare ground
CTGR ________ CT active channel gradient: 1=<1%,2=1-2%,3=2-6%,4=>6%
CTWD ________ channel width: 1=<3ft.,2=3-10ft.,3=>10ft.
CTBL ________ channel median bedload: 1=sand/mud,2=gravel,3=cobbles,4=duff
FISH ________ fish present?: 0=no,1=adults,2=juveniles

TREES

	O	U		
ALRU			ALNUS RUBRA	RED ALDER
CHNO			CHAMAECYPARIS NOOTKATENSIS	ALASKA CEDAR
PISI			PICEA SITCHENSIS	SITKA SPRUCE
PICO			PINUS CONTORTA	SHORE PINE
POTR			POPULUS TRICHOCARPA	BLACK COTTONWOOD
TSHE			TSUGA HETEROPHYLLA	WESTERN HEMLOCK
TSME			TSUGA MERTENSIANA	MOUNTAIN HEMLOCK

TALL SHRUBS

	%		
ALSI		ALNUS SINUATA	SITKA ALDER
CLPY		CLADOTHAMNUS PYROLAEFLORUS	COPPERBUSH
MEFE		MENZIESIA FERRUGINEA	RUSTY MENZIESIA
MYCA		MYRICA GALE	SWEET GALE
OPHO		OPLOPANAX HORRIDUM	DEVIL'S CLUB
RI__		RIBES______________	CURRANT/GOOSEBERRY
RUSP		RUBUS SPECTABILIS	SALMONBERRY
SALIX		SALIX SPP.	WILLOW
VACCI		VACCINIUM OVAL./ALASKEN.	BLUEBERRY
VIED		VIBURNUM EDULE	HIGH BUSH CRANBERRY

LOW SHRUBS

	%		
CA__		CASSIOPE SPP.	CASSIOPE
EMNI		EMPETRUM NIGRUM	CROWBERRY
LUPE		LUETKEA PECTINATA	LUETKEA
PHGL		PHYLLODOCE GLANDULIFLORA	MOUNTAIN-HEATHER

FORBS

	%		
CIAL		CIRCAEA ALPINA	ENCHANTER'S NIGHTSHADE
COAS		COPTIS ASPLENIFOLIA	FERN-LEAF GOLDTHREAD
COCA		CORNUS CANADENSIS	BUNCHBERRY DOGWOOD
EQUIS		EQUISETUM SPP.	HORSETAIL
FACR		FAURIA CRISTA-GALLI	DEER CABBAGE
LYAM		LYSICHITUM AMERICANUM	YELLOW SKUNK CABBAGE
RUPE		RUBUS PEDATUS	FIVE-LEAF BRAMBLE
TITR		TIARELLA TRIFOLIATA	TRIFOLIATE FOAMFLOWER
VEVI		VERATRUM VIRIDE	FALSE HELLEBORE

SEDGES AND GRAMINOIDS

	%		
CATA		CAREX TALL	SEDGE
CASH		CAREX SHORT	SEDGE
CANU3		CALAMAGROSTIS NUTKAENSIS	PACIFIC REEDGRASS
GRASS		TOTAL SEDGE AND GRASS COVER	

FERNS

	%		
ATFI		ATHYRIUM FILIX-FEMINA	LADY FERN
DRAU2		DRYOPTERIS AUSTRIACA	SPINULOSE SHIELD FERN
PO__		POLYSTICHUM__________	SWORD FERN
PTAQ		PTERIDIUM AQUILINUM	WESTERN BRACKEN FERN
THPH		THELYPTERIS PHEGOPTERIS	NORTHERN BEECH-FERN

MOSSES

SPHAG		SPHAGNUM SPP.	SPHAGNUM

PLANT ASSOCIATION:_______

OVERSTORY CHARACTERISTICS

VARIABLE PLOT | FIXED PLOT

Trees (40 BAF)			*Snags (20 BAF) >10 ft. tall				Down Material >10 ft. long		
#TREES	DBH	D=decadent S=sound	C	DBH	HT.	#DECAY CLASS GROUPS	DIA. LARGEST POINT	LENGTH	#DECAY CLASS GROUPS

*Record snags that are cedar with a C.

____ # OF TREE CANOPY LAYERS
____ # OF DIAMETER CLASSES

SNAG DECAY CLASS GROUPS:

1. Branches, twigs, bark intact.
2. Loose bark, secondary branches gone.
3. Bole clean.
4. Top broken.
5. Top broken, bole decomposed.

DOWN MATERIAL DECAY CLASS GROUPS:

1. Tree live. Leaves green.
2. Fresh killed. Needles or leaves still on.
3. Recent dead. Bark intact, limbs present, texture mostly sand, shape round, wood original color, elevated on support points.
4. Intermediate. Bark loose, limbs missing, sapwood decay present, shape round, wood original to faded color, support all to mostly sagging.
5. Decomposing. Bark absent, branch stubs loose, round to oval shape, color faded, all of piece on ground.
6. Decomposed. Wood has deteriorated to punk or tinder.

NOTES & GRAPHICS (Special and unique features, plants, animals, plant communities, influencing offsite factors and comments):

United States Department of Agriculture **Forest Service** **WO**

Reply to: 2410

Date: October 11, 1989

Subject: Old Growth Management

To: Regional Foresters, Station Directors, WO Staff

Enclosed are the Position Statement on National Forest Old-Growth Values and the Generic Definition and Description of Old-Growth Forests. They were developed by the National Old-Growth Task Group and reflect most of the comments received from you, your staffs, and other agencies and organizations. We believe they are important documents to help resolve the old-growth issue.

The Position Statement on National Forest Old-Growth Values is intended to affirm and articulate our view of old-growth forests and how we plan to learn more about them and manage them. Many aspects of this statement have been or are being addressed in the development of the Forest plans. Therefore, we do not anticipate that changes, amendments, or revisions to these plans are needed. In addition, the standards and guidelines in the Forest plans should provide sufficient flexibility in carrying out its provisions, where applicable. We will issue the pertinent parts of the position statement through the manual system. In the interim, our research efforts and field activities should be consistent with its intent.

The Generic Definition and Description of Old-Growth Forests is to serve as a framework for the development or modification of specific old-growth definitions by forest types or type groups. Consistent with the generic definition, the specific definitions are to relate to the structural components of the ecosystem which can be readily identified or measured. The Regional Offices and Experiment Stations are to collaborate and prepare a list, by Region, of the forest types or type groups for which old-growth definitions are to be developed. The Society of American Foresters classification of forest cover types are to be used in preparing these lists. The lists are to be submitted to Dave Unger, as Chairman of the National Old-Growth Task Group, by December 15. The composite list will then be sent to you so that the appropriate offices can coordinate their efforts where the same or similar forest types are common to two or more Regions.

You are encouraged to distribute these documents to your employees and also to use them, as appropriate, in communicating with your publics. By doing so, we may be able to correct some misconceptions by showing that we recognize the many significant values of old-growth forests and are providing for them in managing the National Forests.

/S/ F. DALE ROBERTSON
F. DALE ROBERTSON
Chief

Enclosures

10/11/89

NATIONAL POSITION STATEMENT ON NATIONAL FOREST OLD-GROWTH VALUES

The Forest Service recognizes the many significant values associated with old-growth forests, such as biological diversity, wildlife and fisheries habitat, recreation, aesthetics, soil productivity, water quality, and industrial raw material. Old growth on the National Forests will be managed to provide the foregoing values for present and future generations. Decisions on managing existing old-growth forests to provide these values will be made in the development and implementation of forest plans. These plans shall also provide for a succession of young forests into old-growth forests in light of their depletion due to natural events or harvest.

Old-growth forests encompass the late stages of stand development and are distinguished by old trees and related structural attributes. These attributes, such as tree size, canopy layers, snags, and down trees, generally define forests that are in an old-growth condition. The specific attributes vary by forest type. Old-growth definitions are to be developed by forest type or type groups for use in determining the extent and distribution of old-growth forests.

Where goals for providing old-growth values are not compatible with timber harvesting, lands will be classified as unsuitable for timber production. Where these goals can be met by such measures as extending the final harvest age well beyond the normal rotation or by using silvicultural practices that maintain or establish specific old-growth values, lands will be classified as suitable for timber production. In making these determinations, consideration shall be given to the extent and distribution of old growth on National Forest lands that are Congressionally or administratively withdrawn from timber harvest, as well as adjacent ownerships.

Old-growth values shall be considered in designing the dispersion of old growth. This may range from a network of old-growth stands for wildlife habitat to designated areas for public visitation. In general, areas to be managed for old-growth values are to be distributed over individual National Forests with attention given to minimizing the fragmentation of old growth into small isolated areas. Old growth on lands suitable for timber production and not subject to extended rotations is to be scheduled for harvest to establish young stands which more fully utilize potential timber productivity and also meet other resource objectives.

Regions with support from Research shall continue to develop forest type old-growth definitions, conduct old growth inventories, develop and implement silvicultural practices to maintain or establish desired old-growth values, and explore the concept of ecosystem management on a landscape basis. Where appropriate, land management decisions are to maintain future options so the results from the foregoing efforts can be applied in subsequent decisions. Accordingly, field units are to be innovative in planning and carrying out their activities in managing old-growth forests for their many significant values.

NATIONAL
GENERIC DEFINITION AND DESCRIPTION OF OLD-GROWTH FORESTS
10/11/89

Purpose and Scope

The following describes the ecologically important structural features of old-growth ecosystems. *Measureable criteria for these attributes will be established in more specific definitions for forest types, habitat types, plant associations or groupings of them.* The intent of the generic definition is to guide design of specific definitions and new inventories that include measurement of specific attributes. Although old-growth ecosystems may be distinguished functionally as well as structurally, *this definition is restricted primarily to stand-level structural features which are readily measured in forest inventory.*

Definition

Old-growth forests are ecosystems distinguished by old trees and related structural attributes. *Old growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics which may include tree size, accumulations of large dead woody material, number of canopy layers, species composition, and ecosystem function.*

Description

The age at which old-growth develops and the specific structural attributes that characterize old growth will vary widely according to forest type, climate, site conditions and disturbance regime. For example, old-growth in fire-dependent forest types may not differ from younger forests in the number of canopy layers or accumulation of down woody material. However, *old-growth is typically distinguished from younger growth by several of the following attributes:*

1. Large trees for species and site.
2. Wide variation in tree sizes and spacing.
3. Accumulations of large-size dead standing and fallen trees that are high relative to earlier stages.
4. Decadence in the form of broken or deformed tops or bole and root decay.
5. Multiple canopy layers
6. Canopy gaps and understory patchiness.

Compositionally, old growth encompasses both older forests dominated by early seral species, such as fire-dependent species, and forests in later successional stages dominated by shade tolerant species. Rates of change in composition and structure are slow relative to younger forests. Different stages or classes of old growth will be recognizable in many forest types.

Sporadic, low to moderate severity disturbances are an integral part of the internal dynamics of many old-growth ecosystems. Canopy openings resulting from the death of overstory trees often give rise to patches of small trees, shrubs, and herbs in the understory.

Old-growth is not necessarily "virgin" or "primeval." Old-growth could develop following human disturbances.

The structure and function of an old-growth ecosystem will be influenced by its stand size and landscape position and context.